# The Impact of the COVID-19 Pandemic on Lung Cancer Diagnosis

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## ABSTRACT

**Objective:** During the COVID-19 pandemic, a decrease in hospital admissions has been observed due to fear of exposure to the infectious agent. This situation has raised concerns about a decrease in presentations and delays in diagnosis among patients with symptoms and suspicion of lung cancer. Additionally, it is argued that the increase in the number of thoracic computed tomography scans due to COVID-19 infection supports the view that lung cancer is being detected in early stages. In this study, we aimed to investigate the impact of the pandemic on the diagnosis of lung cancer.

**Methods:** Patients diagnosed with lung cancer in our hospital between 2019-2021 were evaluated retrospectively. The sex, age, TNM classifications, stages, pathological diagnoses and treatments of the patients were recorded and the one-year periods before and after the start of pandemic were compared.

**Results:** 348 patients with lung cancers were included in the study. It was observed that 292 of these patients were diagnosed with non-small cell lung cancer, and 56 patients were diagnosed with small cell lung cancer. 182 patients were detected at the 1A-3A stages of non-small cel lung cancer, relatively early stages, while 110 were detected at the 3B-4B stages at diagnosis. The rate of early-stage non-small cell lung cancer diagnosis was 70.3% before the pandemic and 56.1% after the start of pandemic, with a statistically significant difference (p=0.013). It was found that the rate of those who underwent curative surgery in the non-small cell lung cancer group after the start of pandemic decreased (83/164, 50.6%) when the patient groups were compared in terms of treatment before the pandemic (80/128, %62.5) (p=0.034).

**Conclusion:** Our findings indicate that lung cancer diagnoses may have been delayed due to the restrictions during the pandemic and the anxiety of contracting the disease, or due to the increased burden on health care system.

## INTRODUCTION

Lung cancer threatens public health and leads to significant mortality and morbidity, particularly with increased smoking. The incidence of lung cancer is 30-35% per year in men and 13-14% per year in women worldwide. Research reports that the incidence of lung cancer rises at a rate of 0.5% per year worldwide.[1] Due to the high growth rate and early metastasis, nearly two-thirds of cases present with extensive disease at diagnosis. Despite a positive initial response to chemotherapy and radiation, it is associated with worse long-term survival rates compared to other cancer types.[2,3]

Since the COVID-19 outbreak, there has been a significant fall in hospital admissions because of a fear of exposure by patients other than those with suspected infection to the infectious agent. Besides, there have been many restrictions around the world.[4] This suggests that there may have been some delays in diagnosis and treatment among patients with suspected and treated lung cancer. Moreover, the presence of similar symptoms in lung cancer and COVID-19 pneumonia can be complicated in the differential diagnosis. It also brings to mind the idea of diagnosing lung cancer at an early stage with the increase in the number of thorax computed tomography performed due to the same symptoms. We aimed to investigate the impact of the pandemic on lung cancer diagnosis and treatment in this study.

## MATERIALS AND METHODS

We analyzed the files of 362 patients diagnosed with lung cancer in our hospital from March 15th, 2019 to December 31st, 2019, and from March 15th, 2020 to December 31st, 2020, retrospectively. Patients 18 years or older, with histologically or cytologically proven diagnosis of lung cancer [non-small-cell lung cancer (NSCLC), small-cell lung cancer (SCLC)], were included in the study (Figure 1). Age, sex, tumor histological subtype, TNM classification, stage, and treatments of all patients (chemotherapy, radiotherapy, curative surgery) were recorded. Recurrent lung cancer and patients who did not receive any treatment (treatment denied or out of follow-up) were excluded. Patients were divided into two groups: before the pandemic and after the start of the pandemic. All data before and after the start of the pandemic were compared. The Local Ethics Committee approved the study protocol, number 2022/514/232/8, dated 26.08.2022.

### Statistical Analyses

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 17 software. Descriptive data are expressed as number, mean, standard deviation, minimum-maximum values, and percentages. The chi-square test ($\chi2$) was used to compare categorical values. Statistical significance level was taken as $p<0.05$.

## RESULTS

A total of 362 patients were included in the study. Fourteen patients were excluded from the study because four patients denied treatment, five patients were out of follow-up, and five patients had recurrent lung cancer. Three hun-

dred forty-eight patients with lung cancers, consisting of 259 (74.4%) males and 89 (25.6%) females, were included in the study. The mean age of all patients was 63.8±9.1 years. Demographic characteristics of patients are shown in Table 1. It was determined that 292 (83.9%) patients were diagnosed with NSCLC and 56 (16.1%) patients were diagnosed with SCLC. The most common subgroups in NSCLC were identified as adenocarcinoma (n=132, 37.9%) and squamous cell carcinoma (n=103, 29.6%). One hundred eighty-two patients were detected at the 1A-3A stages of NSCLC (90 patients before the pandemic, 92 patients after the start of the pandemic), relatively early stages, while 110 were detected at the 3B-4B stages (38 patients before the pandemic, 72 patients after the start of the pandemic) at diagnosis. Of all SCLC cases, only three patients were determined to have a limited stage (two patients before the pandemic, one patient after the start of the pandemic) and the remaining 53 patients were determined to have an extensive stage (31 patients before the pandemic, 22 patients after the start of the pandemic). When analyzed according to the years, the number of patients diagnosed in the year before the pandemic was 151 (43.4%), while 197 (56.6%) patients were diagnosed with lung cancer in the year after the start of the pandemic (NSCLC and SCLC). The flowchart is shown in Figure 1. The rate of early-stage NSCLC diagnosis was 70.3% (90/128) before the pandemic and 56.1% (92/164) after the start of the pandemic, with a statistically significant difference (p=0.013). It was found that the rate of those who underwent curative surgery in the NSCLC group after the start of the pandemic (83/164, 50.6%) decreased when the patient groups were compared in terms of treatment before the pandemic (80/128, 62.5%) (p=0.034) (Table 2). No significant difference was found in the SCLC group in terms of stage and curative surgery.
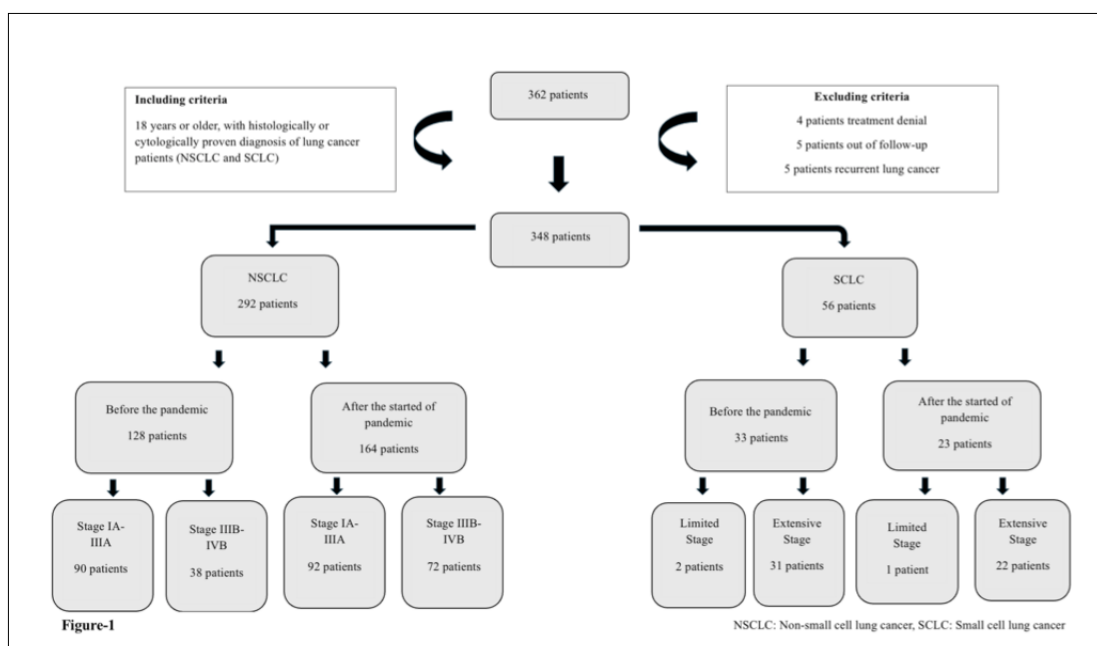


**Figure 1.** Patients 18 years or older, with histologically or cytologically proven diagnosis of lung cancer [non-small-cell lung cancer (NSCLC), small-cell lung cancer (SCLC)].

**Table 1.** Demographic characteristic of patient

|  | Before the pandemic | After the start of pandemic | Total |
|---|---|---|---|
| Age | 63.7±9.6 | 63.9±8.6 | 63.8±9.1 |
| Patient (%) | 151 (%43.4) | 197 (56.6%) | 348 (100%) |
| Gender |  |  |  |
| Female n (%) | 39 (25.8%) | 50 (25.4%) | 89 (25.6%) |
| Male n (%) | 112 (74.2%) | 147 (74.6%) | 259 (74.4%) |

**Table 2.** Comparison of non-small cell lung cancer stage and curative surgery before and after the start of the pandemic

|  | Before the pandemic | After the start of pandemic | p value |
|---|---|---|---|
| Stage 1A-3A (n, %) | 90 (70.3%) | 92 (56.1%) | p=0.013* |
| Curative surgery (n, %) | 80 (62.5%) | 83 (50.6%) | p=0.034* |

*p value<0.05: Statistically significance

## DISCUSSION

We retrospectively investigated 348 newly diagnosed lung cancer cases in March-December 2019 and March-December 2020. Accordingly, 151 patients were diagnosed in the year before the pandemic and 197 in the year after the start of the pandemic. We found that the rate of early-stage NSCLC diagnosis after the start of the pandemic was statistically significantly lower than before the start of the pandemic. Cantini et al.[5] retrospectively scanned cases from 25 Italian Oncology Clinics in March-December 2019 and March-December 2020. Similar to our study, they found that 72% of the patients diagnosed after the start of the pandemic were at Stage 4, statistically significantly higher than those diagnosed before the start of the pandemic. Conversely, in other literature, it was found that there was no statistically significant difference between the years in terms of cancer stages at diagnosis.[6]

In addition, it was found that the rate of those who underwent curative surgery in the NSCLC group decreased after the start of the pandemic when the patient groups were compared in terms of treatment. In the literature similar to our study, the number of patients who underwent surgery decreased after the start of the pandemic, but conversely, it was not statistically significant.[6]

The Netherlands Cancer Registry reported nearly a 30% decrease in all newly diagnosed cancers. This rate has been reported at a similar rate in newly diagnosed lung cancers.[7] Similarly, cases diagnosed with lung cancer from May to October in 2018, 2019, and 2020 were retrospectively compared. The authors reported that 124 (86.1%) cases were newly diagnosed with lung cancer in 2018, 132 (85.7%) in 2019, and 96 (85%) in 2020.[6] Patt et al.[8] retrospectively analyzed and compared cancer cases from the USA in March-July 2019 and March-July 2020. The authors found a significant decrease in the number of cancer screenings, biopsies, surgeries, and outpatient admissions. Furthermore, during April, when the pandemic had the highest impact, the rates of screenings for breast cancer, colon cancer, prostate cancer, and lung cancer were 85%, 75%, 74%, and 56%, respectively. Similarly, the impact of COVID-19 on cancer screenings was retrospectively evaluated, comparing low-dose CT scans for lung cancer before and after the start of the pandemic, and the authors highlighted that both the number of new patients participating in the screening program and the number of patients in the screening program decreased after the start of the pandemic.[9] In cross-sectional studies, it was observed that the rate of new diagnoses decreased by 46% in six common cancers, including esophageal and lung cancer, in the United States between January 2018 and April 2020.[10]

Our work has potential limitations as a retrospective and single-center study. In addition, neoadjuvant or adjuvant chemotherapy types of patients receiving chemotherapy were not recorded.

### Conclusion

We compared the diagnoses of lung cancer stages one year before and after March 2020, when the COVID-19 pandemic was first declared in Turkey. Relatively more cases were diagnosed at a more advanced stage after the start of the pandemic, and relatively fewer patients had the opportunity for curative surgery during the pandemic. Our findings indicate that some lung cancer diagnoses may have been delayed due to the restrictions during the pandemic and the anxiety of contracting the disease, or due to the increased burden on the health care system.

### Ethics Committee Approval

This study approved by the Kartal Dr. Lütfi Kırdar City Hospital Ethics Committee (Date: 26.08.2022, Decision No: 2022/514/232/8).

### Informed Consent

Retrospective study.

**Peer-review**

**Externally peer-reviewed.**

**Authorship Contributions**

Concept: S.F.E.A., S.Ş.C., A.F., S.B.S., N.G.K. N.B.Ö., R.D.; Design: S.F.E.A., S.Ş.C., A.F., S.B.S., N.G.K. N.B.Ö., R.D.; Supervision: S.F.E.A., S.Ş.C., A.F., S.B.S., N.G.K. N.B.Ö., R.D.; Materials: S.F.E.A., N.B.Ö., S.Ş.C., R.D.; Data: S.F.E.A., S.Ş.C., A.F., R.D.; Analysis: S.F.E.A., S.Ş.C., A.F., R.D.; Literature search: S.F.E.A., S.Ş.C., R.D.; Writing: S.F.E.A., S.Ş.C., R.D.; Critical revision: S.F.E.A., S.Ş.C.

**Conflict of Interest**

None declared.

## REFERENCES

1. Dela Cruz CS, Tanoue LT, Matthay RA. Epidemiology of Lung Cancer. In: Grippi MA, Elias JA, Fishman JA, Kotloff RM, Pack AI, Senior RM, et al., editors. Fishman's pulmonary diseases and disorders. 5th ed. New York: McGraw-Hill Education; 2015.

2. Sher T, Grace KDγ, Adjei AA. Small cell lung cancer. Mayo Clin Proc 2008;83:355–67. [CrossRef]

3. Johnson DH. Management of small cell lung cancer: Current state of the art. Chest 1999;116:525–30. [CrossRef]

4. Birkmeyer JD, Barnato A, Birkmeyer N, Bessler R, Skinner J. The impact of the COVID-19 pandemic on hospital admissions in the United States. Health Aff (Millwood) 2020;39:2010–7. [CrossRef]

5. Cantini L, Mentrasti G, Russo GL, Signorelli D, Pasello G, Rijavec E, et al. Evaluation of COVID-19 impact on DELAYing diagnostic-therapeutic pathways of lung cancer patients in Italy (COVID-DELAY study): Fewer cases and higher stages from a real-world scenario. ESMO Open 2022;7:100406. [CrossRef]

6. Serra Mitjà P, Àvila M, García-Olivé I. Impact of the COVID-19 pandemic on lung cancer diagnosis and treatment. Med Clin (Barc) 2022;158:138–9. [CrossRef]

7. Dinmohamed AG, Visser O, Verhoeven RHA, Louwman MWJ, van Nederveen FH, Willems SM, et al. Fewer cancer diagnoses during the COVID-19 epidemic in the Netherlands. Lancet Oncol 2020;21:750–1. [CrossRef]

8. Patt D, Gordan L, Diaz M, Okon T, Grady L, Harmison M, et al. Impact of COVID-19 on cancer care: How the pandemic is delaying cancer diagnosis and treatment for American seniors. JCO Clin Cancer Inform 2020;4:1059–71. [CrossRef]

9. Van Haren RM, Delman AM, Turner KM, Waits B, Hemingway M, Shah SA, et al. Impact of the COVID-19 pandemic on lung cancer screening program and subsequent lung cancer. J Am Coll Surg 2021;232:600–5. [CrossRef]

10. Kaufman HW, Chen Z, Niles J, Fesko Y. Changes in the number of US patients with newly identified cancer before and during the coronavirus disease 2019 (COVID-19) pandemic. JAMA Netw Open 2020;3:e2017267. [CrossRef]

## COVID–19 Pandemisinin Akciğer Kanseri Tanısı Üzerindeki Etkisi

**Amaç:** COVID-19 pandemisinde bulaşıcı ajana maruz kalma korkusu ile hastane başvurularında azalma görülmüştür. Bu durumun, akciğer kanseri semptomları ve şüphesi olan hastaların başvurularında azalma ve tanıda gecikmeler olabileceğini düşündürmüştür. Bunun yanı sıra COVID-19 enfeksiyonu sebebiyle çekilen toraks bilgisayarlı tomografi sayısı arttığından akciğer kanserinin erken evrelerde yakalandığı görüşü de savunulmaktadır. Biz bu çalışmada pandeminin akciğer kanseri tanısı üzerine etkisini araştırmayı amaçladık.

**Gereç ve Yöntem:** Hastanemizde 2019-2021 yılları arasında akciğer kanseri teşhisi konmuş hastalar retrospektif olarak değerlendirildi. Hastaların cinsiyeti, yaşı, TNM sınıflandırmaları, evreleri, patolojik teşhisleri ve tedavileri kaydedildi ve pandemi öncesi ve sonrası bir yıllık dönemler karşılaştırıldı.

**Bulgular:** Çalışmaya 348 akciğer kanseri tanısı konulan hasta dahil edildi. Bu hastaların 292'sine küçük hücreli dışı akciğer kanseri tanısı, 56 hastaya ise küçük hücreli akciğer kanseri tanısı konulduğu görüldü. Küçük hücreli dışı akciğer kanserlerinin nispeten erken evre olan Evre 1A-3A evresinde 182 hasta tespit edilirken, 110 hasta ise 3B-4B evresinde tespit edildi. Pandemi öncesi dönemde erken evre küçük hücre dışı akciğer kanseri teşhisi oranı %70.3 iken, pandemi başlangıcından sonraki dönemde %56.1 olarak bulundu ve bu iki grup arasında istatistiksel olarak anlamlı bir fark tespit edildi (p=0.013). Küçük hücreli dışı akciğer kanseri grubunda pandemi başlangıcından sonraki dönemde küratif cerrahi geçirenlerin oranı (83/164, %50.6), pandemi öncesi döneme (80/128, %62.5) göre karşılaştırıldığında istatistiksel olarak anlamlı olarak azalmış olduğu görüldü (p=0.034).

**Sonuç:** Bulgularımız, pandemi sırasındaki kısıtlamalar, hastalığa yakalanma kaygısı ve sağlık sistemindeki artan yük nedeniyle akciğer kanseri teşhisinin gecikmiş olabileceğini göstermektedir.

**Anahtar Sözcükler:** Akciğer kanseri; COVID-19; pandemic.