

Is There Any Difference Between Pandemic and Pre-Pandemic Periods in Hemoptysis Management?

Hemoptizi Yönetiminde Pandemi ve Pandemi Öncesi Dönem Arasında Fark Var mıdır?

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ABSTRACT

Background: Since it can be a life-threatening condition, hemoptysis is one of the most important emergencies in pulmonology practice. We aimed to determine whether there was a difference in the frequency of hospitalizations due to hemoptysis, and in the etiology of hemoptysis, during the Coronavirus Disease 19 (COVID-19) pandemic period compared to the pre-pandemic period.

Materials and Methods: Retrospective, observational, cross-sectional. According to the date of hospitalization, the patients who were hospitalized during the pre-pandemic (March 11, 2019-March 10, 2020) and pandemic, (March 11, 2020-March 10, 2021) periods were evaluated for eligibility. The Z test was used to determine whether there was a difference between the pre-pandemic and pandemic groups in terms of the frequency of hospitalization due to hemoptysis. $p \leq 0.05$ was considered statistically significant.

Results: There was no significant difference between the groups according to age ($p=0.20$), gender ($p=0.53$), or median length of hospital stay ($p=0.37$). The hospitalization rate due to hemoptysis was 1.9% in the pre-pandemic group and 2.2% in the pandemic group ($p=0.07$). During the pandemic period, the decrease in the rate of hospitalization for all reasons was 30.0%, and the decrease in the rate of hospitalization for hemoptysis was 20.4% ($p<0.0001$). In terms of etiological causes, chronic obstructive pulmonary disease ($p=0.029$) and aspergilloma ($p=0.017$) were observed at significantly higher rates during the pre-pandemic period. COVID-19 was detected as the cause of hemoptysis in 21 (5.9%) cases.

Conclusion: There was no significant difference in the frequency of hospitalizations due to hemoptysis during the pandemic period. However the decrease in all hospitalizations; the decrease in hemoptysis-related hospitalizations was significantly lower. We consider that this may be due to the emergency nature of hemoptysis and the presence of patients with COVID-19 in the pandemic group. A similar proportion of etiological causes and idiopathic cases indicates that there was no difference in the approach to hemoptysis during the pandemic period.

Keywords: COVID-19, epidemiology, hemoptysis, hospitalization, mortality, pandemics

ÖZ

Amaç: Hayatı tehdit edici bir durum olabileceğinden hemoptizi, göğüs hastalıkları pratiğindeki en önemli acil durumlardan biridir. Çalışmamızda, pandemi öncesi dönemle karşılaştırarak, Koronavirüs Hastalığı 2019 (COVID-19) pandemi döneminde, hemoptizi nedeniyle hastaneye yatış sıklığında ve hemoptizi etyolojisinde farklılık olup olmadığını belirlemeyi amaçladık.

Gereç ve Yöntemler: Retrospektif, gözlemsel, kesitsel. Hastaneye yatış tarihine göre, pandemi öncesi (11 Mart 2019-10 Mart 2020) ve pandemi (11 Mart 2020-10 Mart 2021) dönemlerinde hastaneye yatırılan hastalar uygunluk açısından değerlendirildi. Hemoptizi nedeniyle hastaneye yatış sıklığı açısından pandemi öncesi ve pandemi grupları arasında fark olup olmadığını belirlemek için Z testi kullanıldı. $p \leq 0.05$ istatistiksel olarak anlamlı kabul edildi.



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Bulgular: Gruplar arasında yaşa ($p=0,20$), cinsiyete ($p=0,53$) ve ortalanca hastanede kalış süresine ($p=0,37$) göre anlamlı fark saptanmadı. Hemoptizi nedeniyle hastane yatış oranı pandemi öncesi grupta %1,9 iken pandemi grubunda %2,2 olarak bulundu ($p=0,07$). Pandemi döneminde tüm nedenlere bağlı hastane yatış oranındaki azalma %30,0 iken hemoptizi nedeniyle hastane yatış oranındaki azalma %20,4 ($p<0,0001$) idi. Etiyolojik nedenler açısından pandemi öncesi dönemde kronik obstrüktif akciğer hastalığı ($p=0,029$) ve aspergilloma ($p=0,017$) anlamlı olarak daha yüksek oranlarda görüldü. Hemoptizi nedeni olarak 21 (%5,9) olguda COVID-19 saptandı.

Sonuç: Pandemi döneminde hemoptizi nedeniyle hastaneye yatış sıklığında anlamlı bir fark görülmemiştir. Ancak tüm hastaneye yatışlarda azalma olmasına rağmen hemoptizi ile ilişkili hastaneye yatışlarda azalma anlamlı olarak daha düşük olmuştur. Bunun hemoptizinin acil doğası ve pandemi grubunda COVID-19'lu hastaların bulunmasından kaynaklanabileceğini düşünmekteyiz. Ayrıca etiyolojik nedenlerin ve idiyopatik vakaların benzer oranda olması pandemi döneminde hemoptiziye yaklaşımda fark olmadığını göstermektedir.

Anahtar Kelimeler: COVID-19, epidemiyoloji, hemoptizi, hastaneye yatış, mortalite, pandemi

Introduction

Hemoptysis develops from hemorrhage originating from the pulmonary or bronchial vascular system and can clinically manifest as a mild form of streaking in the sputum or as a severe, life-threatening condition due to asphyxia. The etiology of hemoptysis includes many different conditions, such as inflammatory diseases [e.g., tuberculosis (TB)]; bronchial carcinomas and metastases; cardiovascular diseases (e.g., pulmonary embolism and mitral stenosis); and the use of anticoagulant and thrombolytic drugs (1). In Türkiye, TB, lung cancer, and bronchiectasis have been reported to be among the most common causes of hemoptysis (2).

Coronavirus Disease 2019 (COVID-19), caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a member of the coronavirus family, and rapidly spread across the world from Wuhan, China. It was declared a pandemic by the World Health Organization on March 11, 2020 (3). SARS-CoV-2 causes the disease by entering cells containing high levels of angiotensin-converting enzyme-2 receptors, such as alveolar cells, myocytes, and vascular endothelial cells, and binding to these receptors (4). Although hemoptysis, is not a commonly observed symptom in the course of COVID-19 infection, there is evidence in the literature, particularly in case reports (5,6).

We planned this study based on our clinical observation of increased hospital presentations and hospitalizations due to hemoptysis during the pandemic period. Thus, we aimed to investigate whether there were differences in the frequency and etiology of hemoptysis among hospitalized patients during the pandemic period in comparison with the pre-pandemic period.

Materials and Methods

Study Design

Retrospective, observational, cross-sectional.

Patient Selection

All hospitalized patients during the pre-pandemic (March 11, 2019-March 10, 2020) and pandemic (March 11, 2020-March 10, 2021) periods were screened from the hospital's automation system, and those with the International Classification of Diseases (ICD) code of R04.2 (hemoptysis) were identified. The patients were divided into two groups according to their hospitalization date: the pre-pandemic group and the pandemic group.

The inclusion criteria were as follows:

1. Being aged 18 years or over;
2. Being hospitalized and treated due to hemoptysis;
3. Having the etiology of hemoptysis investigated through the examinations performed.

Pregnant women and outpatients were excluded from the study.

Independent Variables

Age, gender, laboratory parameters, length of hospital stay (LOHS, days), comorbidities, etiology of hemoptysis, and in-hospital mortality.

Endpoints

The primary endpoint was an increase in the frequency of hospitalization due to hemoptysis between the two periods. The secondary endpoint was whether there was a difference between the two periods regarding the etiology of hemoptysis.

Statistical Analysis

Demographic data, laboratory parameters, comorbidities, LOHS, final diagnosis at discharge, and the presence of in-hospital mortality were compared between the pre-pandemic and pandemic groups. Demographic data were presented with descriptive statistics [number, percentage, mean and standard deviation, median, and interquartile range (IQR)]. The chi-square test was used to compare categorical variables between the groups, and parametric (Student's t-test) and non-parametric (Mann-Whitney U) tests were used to compare continuous variables, depending on the type of data distribution. The Z test was used to evaluate whether there was a proportional difference between the two groups in terms of hospitalization due to hemoptysis within the total hospitalizations. A p-value of ≤ 0.05 was taken as the statistical significance level. Analyses were carried out using Statistical Package for the Social Sciences (SPSS) 17.5 software program (IBM® SPSS®, Chicago, IL, USA).

Ethics

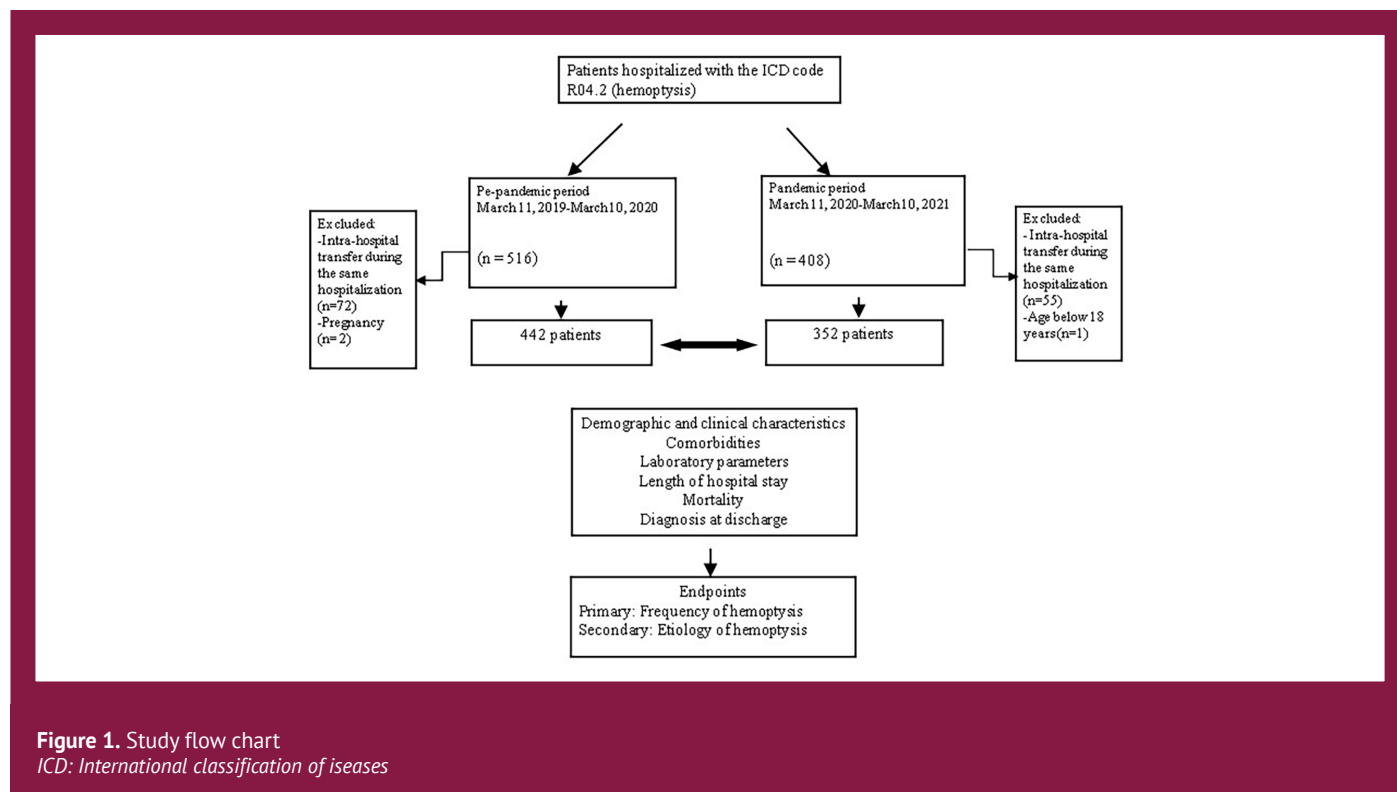
Prior to the study, a scientific research application was made to the Republic of Turkey Ministry of Health, and approval was obtained. Ethical approval of the study protocol, which was prepared in accordance with the Declaration of Helsinki and Good Clinical Practices, was received from the University of Health Sciences Türkiye,

Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital Ethics Committee (approval number: 116.2017.R-218, dated: 01.04.2021). Informed consent was not required since this was a retrospective study that used the hospital database system.

Results

A total of 516 patients hospitalized due to hemoptysis during the pre-pandemic period and 408 patients hospitalized due to hemoptysis during the pandemic period were evaluated for eligibility for participation in the study. After applying the exclusion criteria, 442 patients were included in the pre-pandemic group and 352 patients in the pandemic group (Figure 1). In the pre-pandemic group and pandemic group the ratio of male sex (69.5% vs. 71.6%, $p=0.532$) and the mean age (58.8 ± 15.5 vs. 57.4 ± 15.2 years, $p=0.203$) were not different. The median LOHS (IQR, 25-75) was 6.0 (4.0-9.0) days for the pre-pandemic group and 6.0 (4.0-8.0) days for the pandemic group ($p=0.368$).

Considering the patients in both groups ($n=794$), the most common comorbidities were hypertension ($n=100$, 12.6%), followed by chronic obstructive pulmonary disease (COPD) ($n=89$, 11.2%), coronary artery disease (CAD) ($n=66$, 8.3%), and diabetes mellitus (DM) ($n=63$, 7.9%). No significant difference was found between the two groups in terms of the frequency of comorbidities, except for CAD and



hypertension, which were observed at significantly higher rates among the pre-pandemic group (10.1% vs. 5.9%, $p=0.038$, and 14.4% vs. 9.9%, $p=0.053$, respectively) (Table 1).

The comparison of the two groups according to laboratory parameters revealed a significantly lower C-reactive protein level in the pre-pandemic group ($p=0.011$) and a significantly lower serum troponin level in the pandemic group ($p=0.020$) (Table 2).

The examinations performed for the etiology of hemoptysis revealed that the most common diagnoses received by patients in the pre-pandemic group were lung cancer ($n=96$, 21.7%), lower respiratory tract infections ($n=85$, 19.2%), and bronchiectasis ($n=77$, 17.4%), while 11.1% of the cases were idiopathic (Figure 2A). Similarly, in the pandemic group, the most common etiological diagnoses were lung cancer ($n=87$, 24.7%), bronchiectasis ($n=54$, 15.3%), and lower respiratory tract infections ($n=52$, 14.8%), and the rate of idiopathic cases was 11.6% (Figure 2B). The comparison of the two groups according to the etiology of hemoptysis indicated significantly higher rates of COPD (9.3% vs. 5.1%, $p=0.029$)

and aspergilloma (3.4% vs. 0.9%, $p=0.017$) in the pre-pandemic group. In the pandemic group, the cause of hemoptysis was COVID-19 in a total of 21 (5.9%) patients (Table 3).

In the pre-pandemic period, the total number of hospitalized patients was 23,301, of whom 442 (1.9%) were hospitalized due to hemoptysis. During the pandemic period, the total number of hospitalized patients was 16,321 with hemoptysis being the reason for hospitalization in 352 (2.2%) of these cases. When we applied the Z test to determine whether there was a difference between the two periods in terms of the frequency of hospitalization due to hemoptysis, we found no significant difference ($p=0.071$). However, despite the 30.0% decrease in total patient hospitalizations during the pandemic period, the decrease in hospitalizations due to hemoptysis was 20.4%, and there was a statistically significant difference between these two rates ($p<0.0001$).

In-hospital mortality was observed in eight of the 442 patients (1.8%) in the pre-pandemic group and eight of the 352 patients (2.3%) in the pandemic group ($p=0.80$).

Table 1. Distribution of demographic characteristics and comorbidities in the groups

Variables	Pre-pandemic (n=442)	Pandemic (n=352)	p-value
Sex, n (%)			
Male	307 (69.5)	252 (71.6)	0.532
Female	135 (30.5)	100 (28.4)	
Age, mean (SD)	58.8 (15.5)	57.4 (15.2)	0.203
Comorbidities, n (%)			
Diabetes mellitus	41 (9.3)	22 (6.3)	0.146
Hypertension	65 (14.7)	35 (9.9)	0.053
Coronary artery disease	45 (10.1)	21 (5.9)	0.038
Atrial fibrillation	13 (2.9)	6 (1.7)	0.351
Heart failure	19 (4.3)	12 (3.4)	0.584
COPD	56 (12.6)	33 (9.4)	0.174
Asthma	17 (3.8)	15 (4.3)	0.856
Benign prostate hyperplasia	6 (1.4)	2 (0.6)	0.477
Hypothyroidism	2 (0.4)	3 (0.9)	0.660
Respiratory failure	32 (7.2)	25 (7.1)	1.000
GIS tumor	4 (0.9)	2 (0.6)	0.699
Breast cancer	1 (0.2)	3 (0.9)	0.327
Sepsis	8 (1.8)	1 (0.3)	0.086
Rheumatological disease	9 (2.0)	6 (1.7)	0.799
Reflux	8 (1.8)	5 (1.4)	0.783
Renal failure	8 (1.8)	4 (1.2)	0.564
Dementia	6 (1.4)	2 (0.6)	0.477
Pre-pandemic: March 11, 2019-March 10, 2020, Pandemic: March 11, 2020-March 10, 2021. COPD: Chronic obstructive pulmonary disease, GIS: Gastrointestinal system, SD: Standard deviation			

Table 4 presents the demographic, clinical, and radiological characteristics of the 21 (5.9%) cases diagnosed with COVID-19 in the pandemic group. In this sub-group of patients, 16 (76.2%) were male, the median age was 54.0 (44.5-69.0) years, and the median LOHS was 5.5 (2.0-8.5) days.

Discussion

In this study, in which we compared the frequency of hospitalizations due to hemoptysis and etiological factors during the pandemic period with the pre-pandemic period, we did not detect any significant difference between the two groups, which was the primary endpoint of the study. Although, the decrease in the rate of hospitalizations due to hemoptysis was less than the decrease in the rate of all hospitalizations during the pandemic period, the difference between these rates was found to be statistically significant.

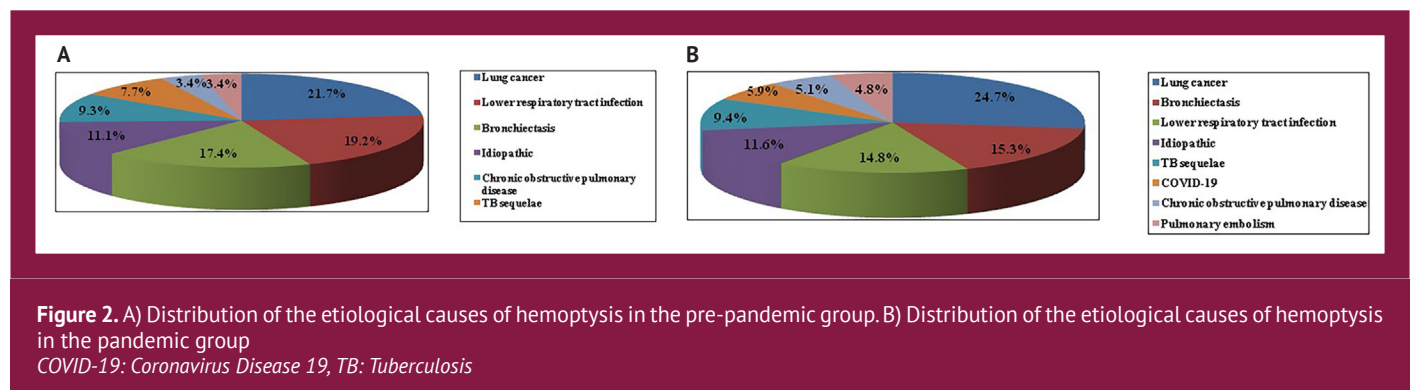
During the pandemic period, COVID-19 was identified as the etiological factor in a total of 21 (5.9%) patients.

It is evident that studies within the literature exhibit significant variations in both the causes and prevalence of hemoptysis across different countries. In large series, the mean age of patients varies between 40 and 70 years, and the male sex is significantly predominant (7-9). For example, in a study examining the five-year records of a national hospital in France, to which approximately 15,000 cases of hemoptysis are admitted every year, the mean age was reported to be 62 years, and the male/female ratio was found to be 2/1 (10). In the current study, the mean age of the patients in both groups was approximately 60 years, and approximately 70% of the cases were male. The pre-pandemic and pandemic groups did not significantly differ according to demographic characteristics. In a retrospective study conducted in Japan, and including 28,539 patients, the mean LOHS was found to be 19±43 days among

Table 2. Comparison of laboratory parameters between the groups

Parameter	Pre-pandemic (n=442)	Pandemic (n=352)	p-value
WBC count, median (IQR)	7.8 (6.4-9.8)	7.5 (6.1-9.6)	0.373
Lymphocyte count, mean ± SD	1690.0±0.7	1730.0±0.8	0.444
Hemoglobin, mean ± SD	12.0±2.0	12.0±2.1	0.861
Hematocrit, mean ± SD	36.8±6.4	36.9±6.1	0.924
Platelet, median (IQR)	260.0 (211.0-343.0)	253.0 (209.0-326.0)	0.150
Urea, median (IQR)	32.0 (26.0-42.0)	32.0 (24.0-41.0)	0.372
Creatinine, median (IQR)	0.8 (0.6-0.9)	0.7 (0.6-0.9)	0.104
Troponin, median (IQR)	5.7 (2.4-13.2)	3.7 (1.9-8.3)	0.020
Pro-BNP, median (IQR)	153.2 (54.7-676.7)	145.0 (53.1-419.0)	0.407
CRP, median (IQR)	11.2 (3.9-11.2)	16.4 (53.1-419.0)	0.011
D-dimer, median (IQR)	0.5 (0.3-1.2)	0.9 (0.3-0.8)	0.076
INR, median (IQR)	1.1 (1.0-1.2)	1.1 (1.0-1.2)	0.057
Procalcitonin, median (IQR)	0.11 (0.05-0.12)	0.05 (0.04-0.13)	0.100

Pre-pandemic: March 11, 2019-March 10, 2020, Pandemic: March 11, 2020-March 10, 2021. BNP: B-type natriuretic peptide, CRP: C-reactive protein, INR: International normalized ratio, IQR: Interquartile range, SD: Standard deviation, WBC: White blood cell



patients who were not given tranexamic acid and 15±17 days among those who were administered this agent (11). The LOHS may vary depending on the etiology and severity of hemoptysis and the medical or surgical methods applied. In another retrospective study, the mean LOHS in patients with moderate and severe hemoptysis was reported to be 8.6 days when bronchial artery embolization was not

performed (12). Bronchial artery embolization was not performed in our center during both specified periods. Our patient population was heterogeneous in both groups, and the etiology of hemoptysis varied greatly. However, the median LOHS was calculated to be 6 days, with no significant difference between the groups.

Table 3. Group comparisons according to the etiology of hemoptysis

Etiological cause	Pre-pandemic (n=442) n (%)	Pandemic (n=352) n (%)	p-value
Lung cancer	96 (21.7)	87 (24.7)	0.310
Pulmonary embolism	15 (3.4)	17 (4.8)	0.364
COPD	41 (9.3)	18 (5.1)	0.029
Bronchiectasis	77 (17.4)	54 (15.3)	0.501
TB sequelae	34 (7.7)	33 (9.4)	0.441
Pulmonary TB	10 (2.3)	9 (2.6)	0.818
COVID-19	0 (0.0)	21 (5.9)	0.000
HF, heart valve disease	4 (0.9)	4 (1.1)	0.737
Anticoagulant drug use, coagulation disorder	5 (1.1)	4 (1.1)	1.000
Aspergilloma	15 (3.4)	3 (0.9)	0.017
Idiopathic	49 (11.1)	41 (11.6)	0.822
Upper respiratory tract infection	6 (1.4)	2 (0.6)	0.477
Lower respiratory tract infection	85 (19.2)	52 (14.8)	0.109
Laryngeal cancer	0 (0.0)	2 (0.6)	0.195
Vascular pathology	1 (0.2)	2 (0.6)	0.587
Interstitial disease, sarcoidosis	5 (1.1)	2 (0.6)	0.477

Pre-pandemic: March 11, 2019-March 10, 2020; Pandemic: March 11, 2020-March 10, 2021.

COPD: Chronic obstructive pulmonary disease, COVID-19: Coronavirus Disease 19, HF: Heart failure, TB: Tuberculosis

Table 4. Demographic, clinical, and radiological characteristics of patients with Coronavirus Disease 19

Patient number	Age/sex	Radiological findings	Comorbidity	LOHS	Mortality
1	67/M	Sequelae changes, consolidation, and bilateral ground glass infiltration	Atrial fibrillation and lung cancer	3 days	Present
2	54/M	Bilateral patchy ground glass infiltration	COPD	14 days	Absent
3	45/M	Bilateral ground glass infiltration and unilateral consolidation	COPD	7 days	Absent
4	71/M	Bilateral bronchial wall thickening and unilateral tree-in-bud pattern	HF	13 days	Absent
5	44/F	Focal consolidation	Asthma	2 days	Absent
6	73/F	Bilateral band atelectasis	None	6 days	Absent
7	62/M	Focal infiltration	Lung cancer	11 days	Absent
8	71/M	Unilateral consolidation	None	10 days	Absent
9	45/M	Traction bronchiectasis and bilateral patchy ground glass infiltration	None	2 days	Absent
10	39/M	Unilateral consolidation	Hepatitis C	4 days	Absent
11	46/M	Unilateral consolidation with sequel findings	Reflux	5 days	Absent
12	56/M	Bilateral peripheral ground glass opacity	Emphysema	9 days	Absent

Table 4. Continued

Patient number	Age/sex	Radiological findings	Comorbidity	LOHS	Mortality
13	94/F	Bilateral bronchial wall thickening	CAD	8 days	Absent
14	49/M	Paraseptal emphysema, bilateral ground glass infiltration, and consolidation	None	4 days	Absent
15	65/F	Bilateral focal ground glass infiltration, tree-in-bud pattern, and consolidation	Lymphoma	6 days	Absent
16	82/M	Bilateral minimal fluid, emphysema, and ground glass infiltration	HF and COPD	6 days	Absent
17	37/M	Paraseptal emphysema and ground glass infiltration	None	7 days	Absent
18	29/M	Diffuse ground glass infiltration and bronchiectasis	None	1 days	Absent
19	31/F	No parenchymal lesions	None	2 days	Absent
20	63/M	Paraseptal emphysema and unilateral ground glass opacity	Hypertension	2 days	Absent
21	51/M	Diffuse ground glass infiltration and mild bronchiectasis	None	7 days	Absent

CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease, F: Female, HF: Heart failure, LOHS: Length of hospital stay, M: Male

The most common comorbidities in our patients were determined to be COPD, hypertension, CAD, and DM. Although this situation did not change, the rates of patients presenting to the hospital with the comorbidities of hypertension and CAD were significantly lower during the pandemic. It has been reported that non-COVID-19 hospital admissions have decreased since the onset of the pandemic. In the USA, this decrease has been determined to be approximately 40% for COPD and asthma (13). In our study, we found this to be valid for hypertension and CAD, which are chronic cardiac conditions. Hospitalization rates were similar for other comorbidities. However, in the evaluation of these findings, the few patients among our group with other comorbid conditions should be taken into consideration.

In terms of etiological factors, lung cancer was the most common cause of hemoptysis in both groups (pre-pandemic: 21.7%, pandemic: 24.7%). In previous studies conducted in Türkiye, lung cancer was reported as the most common cause, with a rate of approximately 28% (2-14). Underlying factors may vary across different regions and socio-economic levels around the world, and this variation is also associated with the severity of hemoptysis. It has been proven that lung cancer (30.3%) and bronchiectasis (27.9%) are the leading causes of moderate and severe hemoptysis in North America. (12) In developing countries where TB is endemic, TB has an important place in the etiology of hemoptysis (15-17). In a retrospective study conducted in Portugal with 237 patients, the most common causes of hemoptysis in adults were determined to be pulmonary TB, sequelae, and bronchiectasis. Active infections, such as pneumonia and tracheobronchitis, were held responsible

for hemoptysis in 51 of the cases (18). Bronchiectasis, pneumonia, and malignancies are also prominent in other publications addressing the etiology of hemoptysis (19,20). Our comparison of the groups according to the underlying factors for hemoptysis revealed that the rates of hemorrhages due to COPD and aspergilloma were significantly higher during the pre-pandemic period. Pulmonary aspergilloma is a saprophytic infection that develops in cavitory lung diseases, especially in post-tuberculosis sequela lesions. It is an important and common risk factor, especially for the development of massive hemoptysis (21-23). We did not detect any difference between the two periods in terms of the frequency of active pulmonary TB. However, considering the chronic course of both COPD and aspergilloma, this proportional difference may have emerged due to changes in how patients presented during the pandemic. Interestingly, we found that the idiopathic cases were very similar, having a rate of approximately 11% for both periods. There are highly variable data in the literature concerning the frequency of idiopathic hemoptysis across different centers and countries. In Türkiye, two different centers reported this rate to be 7.7% and 21.8% (14-24). In a retrospective study conducted abroad with 772 patients, researchers observed that lung cancer developed in seven of 135 (19%) patients with unknown etiology during long-term follow-up, (mean: 6 years) (25). As is known, flexible and rigid bronchoscopy are important interventional methods in the diagnosis and management of patients presenting with hemoptysis. In our center, these procedures continued to be performed during the pandemic period, with the necessary precautions taken in clinical cases with indications such as hemoptysis. The

fact that the rate of idiopathic cases was similar before and during the pandemic period, and that our hospital's data was compatible with the general literature, suggests that there was no difference in the approach to patients with hemoptysis during this period.

Although the hospitalization rate due to hemoptysis was lower in the pre-pandemic group, no significant difference was detected between the two periods. However, while there was a 30.0% decrease in all hospitalizations during the pandemic period, this rate was 20.4% in hospitalizations due to hemoptysis. This difference was statistically significant. To the best of our knowledge, no comprehensive studies have investigated the frequency of hospital presentations or hospitalizations due to hemoptysis during the pandemic period. There may be two reasons why hospitalizations due to hemoptysis were less affected than all hospitalizations during the pandemic. First, there were 21 COVID-19 cases during the pandemic period, representing approximately 6% of all causes of hemoptysis, which may have had an impact on the result. Second, hemoptysis is one of the important chest disease emergencies. It is a symptom that cannot delay the patient's presentation to the hospital.

The evaluation of the demographic and clinical characteristics of the 21 cases diagnosed with COVID-19 as a cause of hemoptysis, in the pandemic group, showed that the median age and LOSH were slightly lower among these patients than in the overall pandemic group. Hemoptysis is a rare symptom in patients with COVID-19 and is occasionally reported in case reports. In a study conducted in China, hemoptysis was observed in 0.9% of 1,099 patients with COVID-19 (26). In a study examining the symptoms and findings of 1,487 outpatients with COVID-19 in France, hemoptysis was detected at a rate of 3% (27). Venous and arterial thrombotic complications, and extensive lung damage, which are likely to develop during the course of COVID-19, are considered to be predisposing factors for the development of hemoptysis. Cases of hemoptysis have been reported in the presence of pulmonary embolism (28). In a series from Türkiye describing three cases diagnosed with COVID-19 which had massive hemoptysis, radiological findings accompanying these cases were reported to include bronchiectasis, and ground glass opacities, suspicion of malignancy in one case (5). Atypical localized consolidation or ground glass infiltration, and multiple cavitary lesions have been observed in patients with hemoptysis as the presenting symptom (29,30). Pulmonary embolism was not detected in any of our cases; however, two patients had lung cancer. We consider that underlying bronchiectasis, malignancies, and sequelae are important for increased

susceptibility to hemoptysis in the presence of a viral condition such as COVID-19 infection.

Study Limitations

The single-center nature of our study and the use of data obtained from a tertiary hospital may pose a limitation in terms of generalizing the results. Additionally, regarding the study design, it is possible that certain factors contributing to the development of hemoptysis were not adequately represented. Another limitation is related to the absence of long-term follow-up data, which is particularly necessary for COVID-19 cases hospitalized due to hemoptysis, especially in those with underlying conditions that constitute risk factors for hemoptysis. Since patient selection was made according to the ICD-10 (R04.2) diagnosis code, cases may be missed due to incorrect coding or incomplete documentation. This is considered another potential limitation. Nevertheless, there is no similar, comprehensive study in the literature investigating the frequency and etiology of hemoptysis during the pandemic period. We anticipate that our research will make a valuable contribution to the existing body of knowledge on hemoptysis, an important chest disease emergency.

Conclusion

We found no significant difference in the frequency of hospitalizations due to hemoptysis during the pandemic period compared to the pre-pandemic period. However, the decrease in the rate of hospitalizations due to hemoptysis was found to be less compared to the decrease in the number of all hospitalizations during the pandemic period. This may be due to the inclusion of COVID-19 in the etiology or the emergent nature of hemoptysis. The similarity of etiological causes between the pre-pandemic and pandemic periods, including idiopathic cases, indicates that there was no difference in the approach to hemoptysis during the pandemic period.

Ethics

Ethics Committee Approval: Ethical approval of the study protocol, which was prepared in accordance with the Declaration of Helsinki and Good Clinical Practices, was received from the University of Health Sciences Türkiye, Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital Ethics Committee (approval number: 116.2017.R-218, dated: 01.04.2021).

Informed Consent: Informed consent was not required since this was a retrospective study that used the hospital database system.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.A.H., M.K., N.D.K., Concept: M.A.H., N.D.K., Design: M.K., N.D.K., Data Collection or Processing: M.A.H., M.K., N.D.K., Analysis or Interpretation: M.K., N.D.K., Literature Search: M.A.H., M.K., Writing: M.A.H., N.D.K.

Conflict of Interest: No conflict of interest was declared by the authors.

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