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Management of patients who underwent bronchoscopy due to massive hemoptysis and the importance of bronchial artery embolization

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Abstract:

BACKGROUND AND AIM: The aim of this study is to evaluate the etiology, length of stay, treatment modality and treatment success in patients who underwent bronchoscopy due to massive hemoptysis.

METHODS: The study is a cross-sectional study and was carried out with 148 patients who were transferred to our center with the complaint of massive hemoptysis between January 1, 2018 and January 1, 2021.

RESULTS: The average age of the study group is 55.64±17.54. 71.6% of the patients in the study group were male. Etiological causes of patients with massive hemoptysis who underwent bronchoscopy were determined as bronchiectasis, lung cancer, tuberculosis, arterio-venous malformation and aspergilloma, respectively. The patients underwent 64.9% bronchial artery embolization (BAE), 29.7% medical treatment and 5.4% surgical treatment. The average length of stay in the intensive care unit is 4.66 days, while the length of stay in the service is 3.51 days. Relapse was seen in 9.45% of patients after BAE. The mean time to recurrence was 137.28 days. It was determined that hemoptysis recurred under 90 days in 8 cases and over 90 days in 6 cases. The success rate of BAE treatment was 90.55% and no mortal complications were observed.

CONCLUSIONS: Massive hemoptysis is a life-threatening and urgent condition. Maintaining airway patency and controlling bleeding is a priority. We think that the patient should be hospitalized and followed up in the intensive care unit, contrast-enhanced thorax computed tomography and bronchoscopy should be performed in the rapid diagnosis process, BAE should be preferred first in the treatment, and surgical and other treatments should be applied if necessary.

Keywords:

Bronchial artery embolization, bronchoscopy, hemoptysis, massive hemoptysis

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Introduction

Massive hemoptysis is defined bleeding of 300 ml or more in a 24-hour period.[1] However, the important point is that asphyxia that may occur due to obstruction of the trachea and respiratory tract may cause death despite not bleeding as much, in other words, not going through hemorrhagic shock. In this regard, 150 mL of bleeding is enough for fatality in an adult patient.[2] Massive hemoptysis accounts for approximately 5% of hemoptysis cases. Due to the life-threatening effect, massive hemoptysis is a clinical condition that requires close follow-up and immediate treatment. It usually indicates potential serious respiratory or systemic disease. An interdisciplinary cooperation is required to successfully treat the hemoptysis. It is a process of diagnosis, treatment, and follow-up conducted by pulmonologists, thoracic surgeons, and interventional radiologists.[3] Even small amounts of bleeding in the tracheobronchial aspiration system may fill the air spaces and cause asphyxia.[4] Since asphyxia occurred in patients with bleeding of 200 ml or more, a study conducted in Turkey suggested defining the bleeding amount of massive hemoptysis as 200 ml.[5] Other known common causes of massive hemoptysis are tuberculous bronchiectasis, lung cancer, lower respiratory tract infections, and aspergilloma.[6] However, geographical location influences the causes of massive hemoptysis.[7] It was reported that cases of death exceeded 50% rate when case management of massive hemoptysis could not be performed.[8] The aim of the study that we carried out in our tertiary center where patients with massive hemoptysis were referred to is to evaluate the etiology, length of hospital stay, type of treatment, and success of therapy in patients who underwent bronchoscopy due to with massive hemoptysis.

Materials and Methods

Study design

This is a cross-sectional study that consists of 148 patients who were transferred to our Harran University Chest Diseases clinic with a massive hemoptysis diagnosis between January 1, 2018 and January 1, 2021. The study was approved by the Harran University Ethics Committee (13.01.2020; hearing: 01; decision no: 17). An informed written consent was gotten from every patient before participants into the study regarding adherence to the guidelines of the declaration of Helsinki.

At most 12 hours following the admission, both contrast-enhanced thorax computed tomography and bronchoscopy (fiber optic and rigid) were conducted to detect the site of bleeding. Etiologies of massive hemoptysis were classified as lung cancer, tuberculosis, bronchiectasis, aspergilloma, and arteriovenous malformations among others. Other classification category consisted of anticoagulant therapy, hydatid cyst. For each patient was planned a treatment based on their etiologies, interventional radiology, opinions of thoracic surgeons. Three treatment protocols were utilized for this study. These protocols were medical treatment, BAE, surgical intervention. The medical treatment was arranged. BAE and surgical intervention protocols were planned.

We accepted the massive hemoptysis bleeding rate threshold as 200 ml and above in our study. The treatment methods used, intensive care and service length of stay were noted. Follow-up care for recurrence was conducted on patients who underwent BAE. Massive hemoptysis recurrences that occurred up to 3 months after BAE were defined as early, and massive hemoptysis recurrences after 3 months were defined as late.[9]

Statistical analysis of data

The data obtained was evaluated with the IBM SPSS Statistics for Windows, Version 20.0 (Armonk, NY: IBM Corp.). The frequency/percentage, mean and standard deviation distribution of age, gender, etiology and treatment type, length of stay in the service, length of stay in the intensive care unit, and recurrence time were calculated. The treatment success of those who had undergone a BAE was compared with the Chi-square test. A value of $p<0.05$ was considered statistically significant.

Results

The age of 148 patients in the study group ranged from 18 to 87, with an average of 55.64±17.54 years. 71.6% of the patients in the study group were male and 28.4% of them were female patients. 29.7% of the patients in the study group had undergone medical treatment, 5.4% surgical treatment and 64.9% BAE. After the examinations, it was determined that the etiological causes of the patients are: Bronchiectasis of 44.6%, lung cancer of 18.9%, tuberculosis of 16.2%, arteriovenous malformation of 8.1%, aspergilloma of 6.8%, other causes of 5.4% (Table 1).

Table 1: Distribution of etiology and applied treatment

Etiology	n	%
Bronchiectasis	66	44.6
Lung cancer	28	18.9
Tuberculosis	24	16.2
Arteiovenous malformation	12	8.1
Aspergilloma	10	6.8
Other	8	5.4
Applied treatment		
Medical treatment	44	29.7
Surgical treatment	8	5.4
Bronchial artery embolization	96	64.9

Table 2: Distribution of cancer types detected according to the existence of endobronchial lesion (EBL)

	EBL (+)	EBL (–)
Squamous cell cancer	6	3
Adeno cancer	3	–
Small cell cancer	–	1
Carcinoid tumor	1	–
No pathological diagnosis	10	4

Table 3: Service, intensive care unit length of stay and recurrence time

	Min. (day)	Max. (day)	Mean (day)	SD
Length of stay in intensive care	1	31	4.66	5.34
Length of stay in services	0	22	3.51	4.52
Recurrence/mean time	6	240	137.28	26.24

Min.: Minimum, Max.: Maximum, SD: Standart deviation

Table 4: Comparison of treatment success with bronchial artery embolization

Treatment success	Bronchial artery embolization						Test value/ p
	Yes		No		Total		
	n	%	n	%	n	%	
Death	0	0	4	8.7	4	2.7	Fisher/0.092
Healthy	102	70.8	42	29.2	144	97.3	

According to cancer types, the presence of an endobronchial lesion (EBL) was examined. EBL was positive in 6 of the squamous cell cancer, and 3 of the adenocancer patients, while only one patient had EBL among carcinoid tumor and small cell cancer patients. Ten patients with EBL had no pathological diagnosis (Table 2). The length of stay in the intensive care unit of the study group ranged from 1–31 days, averaging 4.66±5.34 days. The average length of service hospitalization is between 0–22 days, averaging 3.51±4.52 days. The recurrence time varies between 6 and 240 days, averaging 137.28±26.24 days (Table 3). While no fatality was observed in those who underwent BAE, two patients were intubated for 21 days and 18 days due to massive hemoptysis. However, hemoptysis and subsequent respiratory failure caused fatality due to infection conditions (Table 4).

Discussion

The etiology of patients with massive hemoptysis who had undergone bronchoscopy were found to be bronchiectasis, lung cancer, tuberculosis, arteriovenous malformation, aspergilloma, and others, respectively. 64.9% of the patients underwent BAE, 29.7% underwent medical treatment and 5.4% underwent surgical treatment. The average length of stay in the intensive care unit is 4.66 days, the length of stay in the hospitalization service, on the other hand, is 3.51 days. Recurrence occurred in 9.45% of patients after BAE. The average time before recurrence was 137.28 days. Hemoptysis recurred in 8 cases under 90 days and in 6 cases over 90 days. The success rate of the BAE treatment was 90.55% and no fatal complications related to BAE has occurred.

The complementary combination of computed tomography and bronchoscopy had a high diagnostic yield when determining the etiology of hemoptysis.[10] A tomography scan and bronchoscopy (fiber optic and rigid) were conducted to detect the bleeding site in our study. Massive hemoptysis patients who had undergone bronchoscopy were included in our study. The etiology of hemoptysis varied periodically. While tuberculosis, bronchiectasis, and lung abscess were the three most common causes of massive hemoptysis during the 1980's.[11,12] in the 2000s however, bronchiectasis, tuberculosis, and lung cancer were the most common causes.[13] In 2015, Yazicioglu et al.[5] found in their study that the most common three etiological causes of massive hemoptysis were bronchiectasis, lung cancer, and arteriovenous malformation. In parallel, another study conducted in the same period of time in India by Singh et al.[14] defines tuberculosis, bronchiectasis, and aspergilloma as the most common causes. In our study, the most common etiological causes of massive hemoptysis were determined to be bronchiectasis, lung cancer, tuberculosis, arteriovenous malformation, and aspergilloma, respectively. Although these results coincide with those of other studies conducted in recent years, we think that the differences arise based on the geographical locations of the studies. Lung cancer; It

was squamous cell lung cancer in 9 cases (32.1%), adeno cancer in 3 cases (10.7%), carsinoid tumor in 1 case (3.6%) and small cell lung cancer in 1 case (3.6%). In addition, 14 cases (50.0%) were evaluated as no pathological diagnosis, suspicious cytology, inadequate specimen, clinical-radiological lung cancer.

In our study sample, 28 of 148 patients had lung cancer. Endobronchial lesion was present in 20 of the lung cancer cases. In our clinic, treatments such as ice-cold saline irrigation, tranexamic acid, diluted epinephrine application, selective intubation with a double-lumen endotracheal tube, and BAE are among the treatment methods for endobronchial lesions. However, although endobronchial interventions such as argon cauterization, cryotherapy, brachytherapy, and stent applications are among the treatment options for endobronchial lesions, they cannot be performed in our clinic due to the lack of necessary interventional tools.

In cases in which the massive hemoptysis could not be managed, one out of every two cases becomes fatal.[8,12] In their study they conducted in 2015, Yazicioglu et al.[5] reported that 63.8% of patients with massive hemoptysis underwent surgical treatment, 24.1% of them underwent medical treatment, and 10.4% of them underwent BAE. Quigley et al.[15] reported that BAE was the most common treatment method that was conducted on patients with massive hemoptysis with the rate of 61.8%. Shigemura et al.[16] reported that they avoided surgery for the treatment of massive hemoptysis and primarily adopted the BAE procedure. In our study, 64.9% of the patients underwent BAE, 29.7% underwent medical treatment and 5.4% underwent surgical treatment. We think that BAE treatment may be the primary choice in centers with interventional radiologists in current day.

It has been stated that the mortality rate caused by massive hemoptysis is more than 50% according to the facilities and case management of the hospital.[8] In another study it was reported that the mortality rate caused by massive hemoptysis was between 6.5–38%.[17] Quigley et al.[15] reported in their study they conducted in United States that the rate of mortality was. The mortality rate in our study was found to be 2.7%. Four cases resulted in death due to asphyxia and hemodynamic problems. No mortality was observed in patients who underwent BAE.

Patients should be followed up after BAE in case of a recurrence. van den Heuvel et al.[18] reported the rate of recurrence as 47%, Anuradha et al.[4] as 55%, Pei et al.[19] as 24.1%, Dabó et al.[20] as 37.3%. In our study, we concluded that the recurrence rate following BAE was 9.45%. The average time before recurrence was 137.28 days. Hemoptysis recurred under 90 days in 8 cases and over 90 days in 6 cases.

In conclusion, massive hemoptysis is a life-threatening and urgent condition. Maintaining airway patency and containing bleeding under control is a priority. Each patient should be evaluated by a pulmonologist, interventional radiologist, and thoracic surgeon in the management of hemoptysis. We think that it is required for patients to be hospitalized and followed up in the intensive care unit. Contrast-enhanced computed thorax tomography and bronchoscopy should be conducted in the rapid diagnosis process. BAE should be preferred primarily in the treatment. Surgical intervention and other treatments should be applied only if necessary.

Limitations

This study particularly consists of massive hemoptysis patients who underwent bronchoscopy among the patients referred with hemoptysis. Moderate and mild hemoptysis cases were excluded from the study. Also; With the departure of the Thoracic Surgeon in 2021, the diagnosis and treatment of massive hemoptysis cannot be made temporarily and the patients are referred to another center. We would like to draw attention to how valuable being a team is for the treatment of massive hemoptysis.

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Conflicts of interest

There are no conflicts of interest.

Ethics Committee Approval

The study was approved by the Harran University Clinical Research Ethics Committee (No: 17, Date: 13/01/2020).

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Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept – Ş.K., M.K, R.C.; Design – Ş.K., M.K, R.C.; Supervision – Ş.K., R.C.; Funding – Ş.K., M.K, R.C., F.C.; Materials – Ş.K., M.K., F.C.; Data collection &/or processing – Ş.K., M.K., R.C., F.C.; Analysis and/or interpretation – Ş.K., M.K., R.C., F.C.; Literature search – Ş.K., M.K., R.C., F.C.; Writing – Ş.K., R.C.; Critical review – Ş.K.

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