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Analysis of Pleural Effusion Cases Diagnosed with Uniportal Video Assisted Thoracoscopic Surgery

Tek Port Video Yardımlı Torakoskopik Cerrahi Uygulanan Plevral Effüzyonlu Olguların Analizi

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ABSTRACT Objective: The aim of our study is to present and analysis of the pleural effusion (PE) cases diagnosed in the last 5 years by pleural puncture on pleurisy cases arriving at the emergency service, or persistent PE despite being followed up and treated at the pulmonary diseases clinic, or where the character of the fluid cannot be defined and finally treated with uniportal (single port) video assisted thoracoscopic surgery (VATS). **Material and Methods:** Between April 2012 and December 2017, it was found that a total of 407 patients with PE. Hospital records of 152 exudative PE (EPE) cases treated by VATS were retrospectively evaluated. The cases were subdivided into four groups on the basis of patient ages of 18-28; 29-39; 40-50 and 51 years and over, the diagnoses made for each group were noted along with the demographic characteristics, hospital stay after VATS and time taken for pleural drainage. **Results:** A total of 152 EPE cases with a mean age of 54.98 years (18-83 yr); consisting of 97 (63.8%) males were included in this study. The mean stay in our clinic was 7.2 (5-12) days; the mean time for tubed drainage took 4.6 (3-7) days. The causes of EPE were nonspecific pleurisy (NSP) (40.8%), malignancie (30.9%), tuberculosis (TB) (27.0%) and sarcoidosis (1.3%). **Conclusion:** In the aetiologies of EPE cases, with TB ranking first in underdeveloped countries and malignancies ranking first in the developed countries. In cases treated with uniportal VATS, incidences of TB, malignant pleurisy and malignant mesothelioma diagnoses are high and the procedure is reliable.

Keywords: Pleural effusion; uniport; VATS

ÖZET Amaç: Bu çalışmanın amacı, son 5 yılda acil servise başvuran ve plevral effüzyon (PE) tespit edilerek plevral ponksiyon yapılan, göğüs hastalıkları kliniğinde takip ve tedavi için izleme alınan ve sonrasında göğüs cerrahi kliniğinde tanı ve tedavi amaçlı uniportal (tek port) video destekli torakoskopik cerrahi (VATS) uygulanan olguların analiz edilmesidir. **Gereç ve Yöntemler:** Nisan 2012 ve Aralık 2017 arasında, PE'li toplam 407 hastadan, VATS ile tedavi edilen 152 eksudatif PE (EPE)'lu hastanın kayıtları retrospektif incelendi. Hastalar 18-28;29-39;40-50 ve 51 yaş ve üstü olmak üzere dört gruba ayrıldı. Her bir grubun demografik özellikleri, tanıları, VATS sonrası hastanede kalış süreleri ve plevral drenaj süreleri kaydedildi. **Bulgular:** Çalışmaya, yaş ortalaması 54,98 (18-83) yıl olan; 97 (%63,8)'si erkek olmak üzere toplam 152 EPE'lu hasta dahil edildi. Ortalama hastanede yatış süresi 7,2 (5-12) gün; ortalama plevral drenaj süresi 4,6 (3-7) gün idi. EPE'nin en sık nedenleri nonspesifik plörezi (NSP) (%40,8), maligniteler (%30,9), tüberküloz (TB) (%27,0) ve sarkoidoz (%1,3) olarak belirlendi. **Sonuç:** EPE etyolojisinde, gelişmekte olan ülkelerde ilk sırada TB ve gelişmiş ülkelerde malignite yer almaktadır. Uniportal VATS ile tanı konulan EPE'da TB, malign plörezi ve malign mezotelyoma tanı oranları yüksektir ve işlem güvenlidir.

Anahtar Kelimeler: Plevral effüzyon; uniport; VATS

The pleura is a potential space lined with a serous membrane between the chest wall and the lungs. The visceral pleura covers the surface of the lung parenchyma and the parietal pleura, the outermost pleural membrane, lines the chest cavity internally. Pleural effusion (PE) forms as a result of imbalance in the release and absorption of pleural fluid and can develop due to different mechanisms including increased permeability of

the pleural membrane, increased pulmonary capillary pressure, reduced intrapleural oncotic pressure or blockage of lymphatic flow.[1] Pleural disorders can present as a result of various systemic diseases as well as lung diseases. PE prevalence in developed countries is believed to be about 320/ 100.000.[2,3] PE can be an exudate or transudate. Causes of the most frequently observed transudative PE cases are cardiac failure, hepatic cirrhosis and hypoalbunaemia; whereas the most frequent causes of exudative PE (EPE) are malignancies, parapneumonic effusion and tuberculosis (TB). The aetiology of about 20% of PE cases cannot be determined.[4] Clinically the patients frequently complain of shortness of breath, dry cough, and chest pain. Proper treatment necessitates determination of the aetiology. The process involves differentiation of whether the fluid is a transudate or an exudate.[5] In recent years an increase has been observed in the number of patients with PE consulting the emergency services and the pulmonary disease polyclinics. The aim of our study is to present and analysis of the PE cases diagnosed in the last 5 years by pleural puncture on pleurisy cases arriving at the emergency service, or cases with persistent PE despite being followed up and treated at the pulmonary dieases clinic, or where the character of the fluid can not be defined despite various biochemical or cytological methods and finally treated with uniportal (single port) video assisted thorascopic surgery (VATS).

MATERIAL AND METHODS

Between April 2012 and December 2017, it was found that a total of 407 patients with pleural effusion. Hospital records of 152 EPE cases treated by VATS at the Thoracic Surgery Clinic of Health Sciences University Bursa Yüksek İhtisas Training and Research Hospital after arrival at the emergency service or the Pulmonary Diseases polyclinic were retrospectively evaluated. The cases included those who did not respond to medical treatment, not diagnosed after clinical and biochemical or cytological investigations. The cases were subdivided into four groups on the basis of patient ages of 18-28; 29-39; 40-50 and 51 years and over, and the diagnoses made for each group were noted along with the demographic characteristics, hospital stay after VATS and time taken for pleural drainage.

Ethics committee approval was received for this study from the ethics committee as a decision number 2018-1/ 37/KAEK Uludag University Faculty of Medicine Ethics Committee.

This study was carried out in accordance with the principles of the Declaration of Helsinki.

DIAGNOSTIC PROCEDURES CARRIED OUT ON PLEURAL EFFUSION CASES

Determination of the aetiology of the PE in the patients included in this study involved consisted of: 1-Evaluating clinical symptoms; 2-Radiological evaluation by postero-anterior and postero-lateral lung imaging by X-ray and computerised tomography-CT; 3-Thoracentesis; and 4- Uniportal VATS application.

SURGICAL METHOD

All patients were operated under general anesthesia at the operating room. After placing patients on the operating table and inducing anesthesia, they were intubated using a double lumen tube. They were placed on the operating table as if a standard posterolateral thoracotomy incision would be made, and they were scrubbed. In lateral decubitus position, the arm was suspended in abduction so that the scapula was maximally elevated. The table was tilted, and a 10 cm high roll pillow was placed under the thoracic cage to maximally expose intercostal spaces. Using a single incision and 0° telescope (Karl Storz, Hopkins II telescopes diameter 5 mm, length 29 cm trocar size 6 mm) imaging, pleural biopsies were taken using biopsy forceps. Entire pleura and pulmonary surfaces were reviewed after the operation. After performing a check for air leaks and haemostasis, a 28F chest tube was placed through the incision site. All patients were extubated at the operating table and transferred to the regular ward.

STATISTICAL ANALYSIS

Continuous variables were expressed as mean ± standard deviation and categorical variables as number and percentage.

TABLE 1: General characteristics of the patients.

Mean Age-years (range)	55 (18-83)
Mean Hospital stay-days (range)	7.2 (5-12)
Mean Pleural drainage -days (range)	4.6 (3-7)
Age Groupings (n,%)	
18-28 years	30 (%19.7)
29-39 years	29 (%19.1)
40-50 years	33 (%21.7)
51 years and over	60 (%39.5)
Gender	
Male (%)	97 (%63.8)
Female (%)	55 (%36.2)

TABLE 2: Distribution of exudative pleural effusion case aetiologies on gender basis.

Aetiology	Male (n%)	Female (n%)	Total (n%)
Nonspesific pleurisy	42 (%43.3)	20 (%36.4)	62 (%40.8)
Malignancy	27 (%27.8)	20 (%36.4)	47 (%30.9)
Tuberculosis	28 (%28.9)	13 (%23.6)	41 (%27.0)
Sarcoidosis	-	2 (% 3.6)	2 (%1.3)

RESULTS

A total of 152 EPE cases with a mean age of 54.98 years (18-83 yr) and consisting of 97 (63.8%) males and 55 (36.2%) females were included in this study. The male to female ratio was 1.7: 1. he mean stay in our clinic was 7.2 (5-12) days; and the mean time for tubed drainage took 4.6 (3-7) days (Table 1). The causes of EPE were nonspecific pleurisy (NSP) (40.8%), malignancies (30.9%), TB (27.0%) and sarcoidosis (1.3%). Among the male patients NSP ranked as the main cause of PE with 43.3% (n:42); TB ranked second with 28.9% (n:28) and malignancies ranked as the third cause with 27.8% (n:27) incidence. Among the female patients NSP and malignancies shared the first rank each with 36.4% (n:20), TB ranked second with 23.6 % (n:13) and, sarcoidosis ranked third with 1.3% (n:2) incidence (Table 2). Distribution of the diagnoses on the basis of age grouping differed with predominance of TB in the 18-28 year group, of NSP in the 29-39 year and 40-50 year groups and malignancies in the ≥ 51 year group (Table 3). Of the total 47 cases of malignancy, 52% were malignant pleural mesotheliomas (MPM) and 48% were various metastatic malignancies (Figure 1).

DISCUSSION

PE can present in association with lung diseases or systemic diseases. Priorities in the search for the aetiology of PE cases consist of clinical investigations and radiological methods, started with postero-anterior and postero-lateral lung radiography. When there is doubt about the fluid localisation,

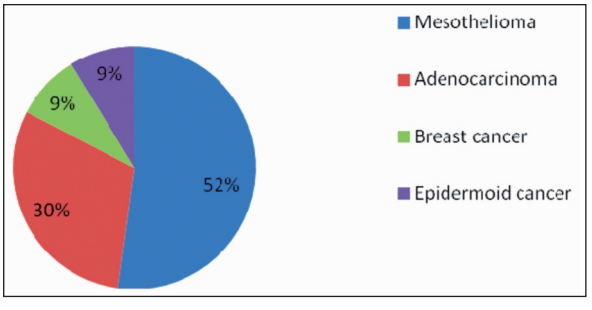

FIGURE 1: Aetiologies of malignant pleural effusion cases.

TABLE 3: Distribution of exudative pleural effusion case aetiologies on age basis.

Age Groupings	18-28 years	29-39 years	40-50 years	51 years and over	Total (n,%)
Tuberculosis	20	9	4	8	41 (%27.0)
Nonspesific pleurisy	10	18	18	16	62 (%40.8)
Malignant pleural mesothelioma	-	1	3	20	24 (%15.8)
Metastatic malignancy	-	1	6	16	23 (%15.1)
Sarcoidosis	-	-	2	-	2 (%1.3)
Total	30	29	33	60	152(%100)

the choice is for CT in order evaluate better the mediastinum and the lungs. Ultrasound-guided thoracentesis in the presence of a small amount of pleural effusion or localized fluid reduces potential complications. Afterwards, thoracentesis is performed and microbiological, cytological and biochemical investigations are carried out to characterise the effluent fluid. Thoracocentesis and closed (blind) pleural biopsy have limited diagnostic significance.[5-8]

The first procedure of uniportal video-assisted thoracoscopic surgery (VATS) was pioneered by Dr. Gaetano Rocco from the National Cancer Institute Naples, Italy. Between 2003–2006 uniportal VATS was performed for pleural effusion, pleurodesis, pleural and mediastinal biopsies, and lung wedge resections.[9-11] Uniportal VATS is becoming accepted worldwide for minor and major procedures to treat thoracic and mediastinal pathologies.[12,13]

Present study evaluation of the pathological data of patients treated with uniportal VATS showed that main PE causes ranked as NSP (40.8%; n:62), malignancies (30.9%; n:47) and pleural TB (27.0%; n:41). Malignant pleural mesothelioma made up 52% (n:24) of the malignancies diagnosed. The aetiological basis of MPM consists mainly of exposure to asbestos or erionite fibers.[14] There is not a definite figure for MPM incidence in our country. The study with the widest scale was carried out by Senyiğit et al. on 506 cases with male/female ratio of 0.7.[15] Diagnoses were made on biopsies, and reported as mainly pleural PE (n=464) and partly peritoneal PE (n=42). The high incidence of MPM cases in our study suggests job related exposure to environmental factors, as the patients lived in one of the largest industrial regions of Turkey; the presence of a large population of Bulgarian immigrants who may have been exposed to causative environmental and job related factors in their native, and also the presence unknown environmental factors in our region. It is important to investigate the birth places of our MPM patients and query the professional occupations of those who could be reached, which is intended as part of a separate study.

Cytological investigation is the most important approach for diagnosis of pleural malignancies with a diagnostic value of 57-62%; its greatest diagnostic value being in identifiation of metastatic adenocarcinomas.[8] Metastatic cancers constituted the highest percentage (48%; n: 23) of malignancies in our PE cases, with 30% being lung cancers, 9% being breast cancers and 9% being epidermoid cancers. The most frequently metastatic cancers originate from lung cancers in male patients and from breast cancers in female patients.[16] In our study the metastatic malignancies diagnosed after VATS were headed by adenocarcinomas mainly in the male patients, followed by epidermoid carcinomas, and breast carcinomas mainly seen in the female patients.

Given the prevalence of TB in our country, it is the first diagnosis that comes to mind in patients with pleurisy. Tuberculous pleurisy (TBP) is accepted as the extrapulmonary TB form and is observed second most frequently after lymph node TB. In many countries the most frequently observed cause of EPE is TBP.[17] In our study, 67% of the EPE cases in the 18-28 year group were diagnosed with TBP, which ranked as the third most frequent (27%) cause of PE in the patients treated with uniportal VATS.

Sarcoidosis cases exhibit 2-4% incidence of PE.[18,19] In the literature, detection of pleural fluid has been reported to be 0.7-10%.[20] Diagnoses are based on the demonstration of epiteloid type noncaseified granuloma which is the typical histopathologic finding made and the elimination of other granulomatous dieases. In our study 2 (1.3%) patients treated with uniportal VATS were diagnosed with sarcoidosis.

There are many studies indicating shorter drainage times in uniportal VATS groups compared to multi-port groups. In the literature, although the mean duration of postoperative drainage varies between 1-4.6 days, it has been stated that its duration was extended up to 15 days in those with postoperatively prolonged air leakage.[21,22] In all our cases, we kept drain 2 more days in situ despite ces-

sation of the air leakage and duration of drainage was calculated as 4.6 days in our study. Prolonged air leakage and pneumonia have developed in one of our cases and duration of the drainage was 7 days in this patient.

Although the length of hospital stay reportedly ranged between 2-6 days, in complicated cases 3 length of hospital stay up to 60 days has been reported.[21] The average length of hospital stay of our patients was consistent with the literature and it was calculated as 7.2 days.

CONCLUSION

There are regional and international differences in the aetiologies of EPE cases, with TB ranking first in underdeveloped countries and malignancies ranking first in the developed countries. There are also aetiological differences based on the decades of life and gender. If diagnosis cannot be made with non-invasive methods in EPE cases, invasive methods have to be considered. Uniport VATS has been recommended as a safe alternative to the conventional multiport VATS technique for thoracic surgery. It reduces surgical trauma and the postoperative hospital stay. In cases treated with uniportal VATS, incidences of TB, malignant pleurisy and malignant mesothelioma diagnoses are high and the procedure is reliable.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Miktat Arif Haberal, Özlem Şengören Dikiş;* ***Design:*** *Halil Kaya, Miktat Arif Haberal;* ***Control/Supervision:*** *Erkan Akar, Halil Kaya;* ***Data Collection and/or Processing:*** *Miktat Arif Haberal, Özlem Şengören Dikiş;* ***Analysis and/or Interpretation:*** *Özlem Şengören Dikiş;* ***Literature Review:*** *Özlem Şengören Dikiş;* ***Writing the Article:*** *Miktat Arif Haberal, Özlem Şengören Dikiş;* ***Critical Review:*** *Erkan Akar, Halil Kaya;* ***References and Fundings:*** *Miktat Arif Haberal;* ***Materials:*** *Miktat Arif Haberal.*

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