



## Case Report

## Radical extrapleural pneumonectomy with bronchial fistula by pulmonary function test evaluation technique

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## ABSTRACT

**Introduction:** and importance: Pulmonary Function Tests (PFTS) is an important tool in the assessment of pulmonary pathologies and preoperative evaluation. **Case presentation:** A 54-year-old man with history of massive pleurisy in the left thorax, treated by placing chest tube and drainage of bloody effusion, was readmitted for epithelioid mesothelioma. He was then presented with pneumothorax due to a refractory bronchial fistula while having a plural catheter. Based on the consultation, the whole-body bone scan was conducted, and findings demonstrated epithelioid mesothelioma (stage 1) with the refractory fistula for which the patient was candidate for thoracic surgery. Decreased lung capacity was seen by Pulmonary Function Testing – PFTS.

**Clinical discussion:** The novel PFTS Evaluation Technique was designed to measure the true pulmonary capacities in order to evaluate the pulmonary post-operative tolerance. In this technique the chest tube was placed for 4 weeks until the patient reaches mediastinal fixation then the measurements by PFTS were carried out in two steps. First, using an open chest tube and second, using a clamped chest tube. In both steps, the pulmonary capacities were measured and provided to the pulmonologist for consultation.

**Conclusion:** In this case, after acquiring the approval of the specialist depended on PFTS after PFTS Evaluation Technique, the radical extra pleural pneumonectomy surgery was conducted, and the patient was discharged with a good general appearance and treated fistula.

## 1. Introduction

Malignant mesothelioma is the most common pleural tumor and nearly 3000 of these cases are reported in a year in the United States [1, 2]. 50% of cases are associated with asbestos exposure among the workers of ship manufacturing companies and their families where asbestos is transferred by the laborers' clothes [3]. It is more common in men with the male to female ratio of 2:1. Often, it is presented after the age of 40 [4]. Exposure to certain materials is considered a risk factors such as serpentine and amphibole fibers [5,6]. Mesothelioma is found in two common forms; localized and diffused malignant form and is often presented with clinical features such as pain and shortness of breath accompanied by pleural effusion in 90% of the cases [7,8]. In cases associated with asbestos exposure, the clinical symptoms may appear

after 20 years. This type of mesothelioma has three main presentations; epithelial cell type, sarcomatoid and mixed [9]. According to the literature, long term survival rate is less than 10% in all groups and the epithelial cell type has the better prognosis relative to other types. When mesothelioma is combined with a long bronchopleural fistula, the treatment can be more complicated and due air discharge caused by the tumoral tissue, the fistula closure cannot be achieved by simple suturing [10,11].

## 1.1. Patient and method

The patient is a 54-year-old nonsmoker male veteran with chief complaint of shortness of breath. He suffered from back ache due to trauma and vertebral surgery caused by combat injuries at 32 years of

; PFTS, Pulmonary Function Tests; MRI, Magnetic Resonance Imaging; ICU, Intensive Care Unit.

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age. The patient was injured several times during war in 1987, injuries including jaw fracture, auditory nerve injury and several fragments in his body (Fig. 1). He underwent surgery in 2007 for treating herniated vertebral disc. In 2010, he was admitted to hospital due to type II viral encephalitis, he stayed in the intensive care unit (ICU) since magnetic resonance imaging (MRI) could not be performed because of a bullet piece in the head. Familial medical history showed that his father passed away due to liver cancer and his mother died due to lymphatic disease.

On June 15th, 2019, he was diagnosed with pleurisy in the left thorax and treated by chest tube drainage with a total 5.5 L of bloody effusion at two different instances. A video associated thoracoscopic surgery – VATS was performed, aiming to conduct biopsy of the lower left lobe. He was admitted again on July 18th for shortness of breath and pleurisy. The result of aspiration was exudative; thus, the patient was admitted again. After going through 3 phases of Chemotherapy, the patient was admitted on August 29th, 2019, with diagnosis of epithelioid mesothelioma, and the pleural catheter was placed where 2000 cc fluid was drained (Table 1).

The patient vital signs on the day of admission were respiratory rate 15 breath/min, blood pressure 120/80 mmHg and pulse rate 100 beats/min. After 5 days, the patient received a pleural catheter, aiming to drain the excess fluid. According to the thoracic consultation, a chest tube was embedded accompanied by a Gomco suction. Due to refractory pleural fistula, whole-body bone scan was performed for metastasis. Due to epithelioid mesothelioma, the patient underwent a radical extra pleural pneumonectomy (Fig. 2, Fig. 3).

Pulmonologist suggested that the surgery cannot be conducted, since the quantitative scan of pulmonary function test could not be performed to evaluate the lungs post-surgery tolerance. As to the mentioned limitations, the patient underwent mediastinal fixation for 4 weeks by using a Gamco suction. Then, the PFTS evaluation technique was performed to assess the lungs' preformation post-surgery tolerance. The patient went under surgery after cardiologist, forensic practitioner and anesthesiologist consultation. (Fig. 4).



Fig. 1. Spiral CT scan of lumbar spine; previous disc operation at L3-L4 level with posterior fixation (screws are seen in the body of L3 and L4 on right side).

In the first step, a spirometry was conducted while the chest tube was open, then the test was performed with clamped chest tube after the mediastinal fixation. This evaluation provided the adequate and necessary information for pulmonologist confirmation and allowance before surgery (Table 2).

This case report has been reported in line with the SCARE 2020 criteria [12]. Written informed consent was obtained from the patient for publication of this case report and accompanying images.

His pleural smear showed acute and chronic inflammation with no signs of malignancy. Spiral CT of thorax with contrast showed severe left pleural effusion along with complete collapse of left lung without shift of mediastinum. Transthoracic echocardiogram showed normal LV size and systolic function, normal RV size and function, mild circumferential pleural effusion and massive pleural effusion. Multi slice CT scan of abdomen and pelvis with oral and IV contrast showed advanced left sided pleural effusion with collapse of the left lung. Liver, spleen, pancreas, and kidneys were normal.

Spiral chest CT-scan without contrast showed collapsed left lung lower lobe associated with massive left sided pleural effusion. Left upper lobe showed massive volume loss and mild mediastinal shift to right side was seen. Multi slice spiral CT scan of chest without contrast axial views revealed 2cm right thyroid hypodense nodule, along hydro-pneumothorax treated with pleural drainage catheter. Minimal chronic changes of right lung base were seen. Early evidence of degenerative joint disease of vertebrae was also seen.

Degenerative disease of vertebrae was manifested by disc space narrowing spurs with pressure effect upon adjacent thecal sac mostly at T11-T12 level. Also, there had been previous disc operation at L3-L4 level with posterior fixation (screws are seen in the body of L3 and L4 on right side).

Whole body bone scan showed L3 spine active lesion and metastasis.

Macroscopic findings of biopsy revealed creamy plaque in the periphery up to 4cm in diameter, along with one black and soft fragment. Microscopic findings showed malignant neoplasm of pleura, composed of atypical cells with tubulopapillary configuration and stromal invasion. Few pigments, similar to asbestos body were visible. Sections showed reactive lymph node with marked anthracosis. The patient was diagnosed with left radical extra pleural pneumonectomy specimen, consistent with malignant mesothelioma of epithelioid type.

## 2. Discussion

Malignant mesothelioma is a malignancy involving the visceral and peripheral pleura and surrounding tissue [13]. It causes reduced lung capacity, pleurisy and progressive dyspnea [14]. Placement of chest tube could lead to adverse effects like exacerbation of the clinical signs and symptoms, such as bronchial fistula in involved lung and refractory pneumothorax [15]. Thus, in this condition when the PET scan shows non-metastatic tumor and the tumor is single, making decision for radical extra pleural pneumonectomy operation by quantitative scan cannot be done, because of leakage of air from fistula can cause complications [16,17].

In mediastinal fixation approach, the chest tube is placed for 4–6 weeks [18]. PFTS evaluation technique has two phases; PFTS is done first with open chest tube and in second phase while the mediastinal is fixed before, PFTS is completed by clamped chest tube and without any air leakage [19]. This method helps to evaluate the decent information of spirometry and compare true lungs measurement items for confirming the lung capacity in choosing the proper treatment [20].

## 3. Conclusion

The patient with pulmonary fistula cannot undergo pneumonectomy surgery because of lack of decent information using PFTS, radical extra pleural pneumonectomy surgery can be effective.

**Table 1**  
Result of Video-assisted thoracoscopic surgery.

		Date	FEF <sub>50</sub>		FEF <sub>25</sub>	PEF	FEV1/FVE	FEV1	FVE
Before VATS		11/06/2019	41.3		40	37.8	99.19	38.9	31.4
After VATS	Before mediastinal fixation	07/09/2019	41		45.1	51.9	79.14	67.7	68.4
	After mediastinal fixation		Open tube	95	124	62	114	85	76
				Clamped tube	104	138	70	115	91

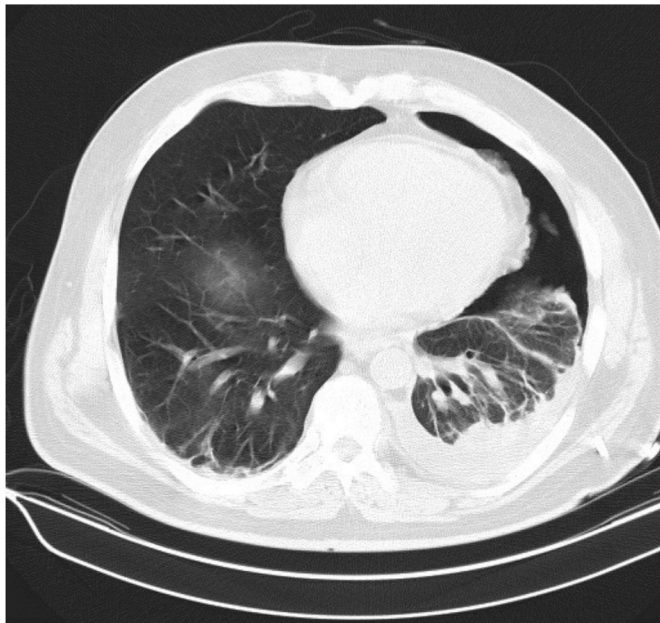


Fig. 2. Inferior left pleural thickness with pneumothorax.

**Ethical approval**

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Sources of funding**

No funding was secured for this study.

**Contributors' statement page**

Dr. Saeid Marzban-Rad: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Parastesh Sattari: and Dr. Rama Bozorgmehr: Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Ghasem Azimi and Dr. Ali Azimi: Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

**Research registration**

N/A.

**Guarantor**

Saeid Marzban-Rad.

**Consent to participate**

Patient consent was obtained prior to the surgery.

**Availability of data and material**

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

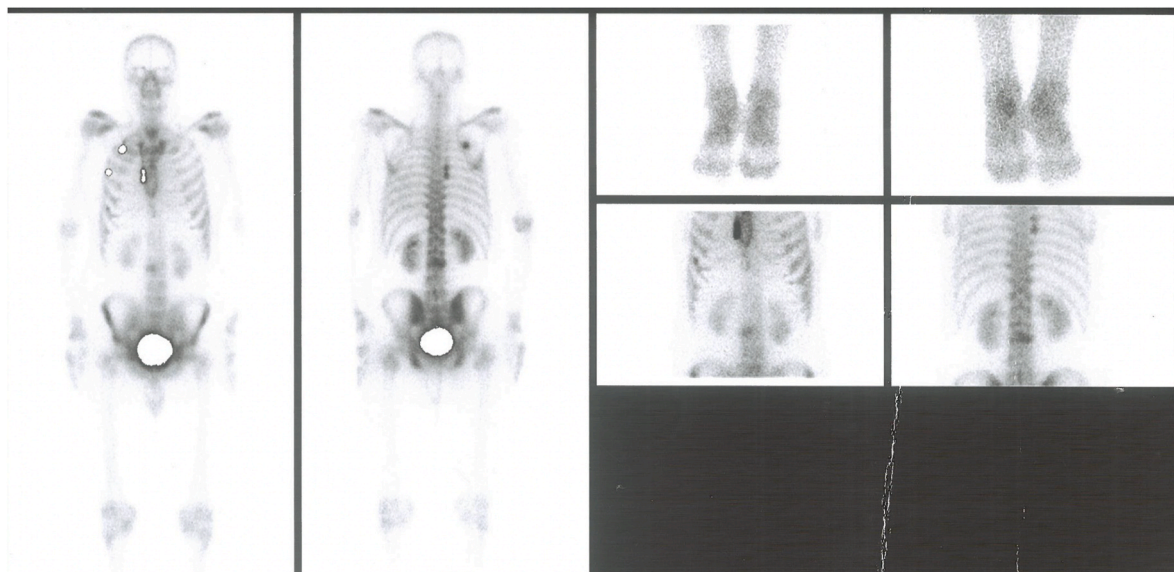


Fig. 3. Normal whole body bone scan.





Fig. 4. Post operation chest radiography with left pleural effusion.

Table 2

Result of laboratory test.

Laboratory tests	22/06/ 2019	2019/06/ 13	03/09/ 2019	01/11/2019
FBS(mg/dl)	89	123	90	99
BUN(meq/L)	14	24	15	11
Creatinine (mg/ dl)	1.2	1.2	1.3	1.1
sodium (meq/L)	125	133		
potassium (meq/ L)	4	3.4		
WBC( $10^3$ / $mm^3$ )	10.77	7.9	15.02	12.86
RBC	5.23		3.76	
Hemoglobin (gr/ dl)	45.8	10.9	10.7	9.1
platelet ( $10^3$ / $mm^3$ )	140		205	
BS(mg/dl)	121			125
Neut %	70.3		85.7	61.8
Lymp %	18.0		10.0	20
Blood culture				Staphylococcus aureus
Sputum culture				Burkholderia cepacia
Direct Smear (BK)	Negative			
ESR mm/hr	4			

#### Consent for publication

Written informed consent was obtained from the patient for

publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Provenance and peer review

Not commissioned, externally peer-reviewed.

#### Declaration of competing interest

The authors deny any conflict of interest in any terms or by any means during the study.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.103071>.

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