

ORIGINAL ARTICLE

Assessment of Dyspnea, ECOG and Karnofsky Performance Scale after VATS Pleurodesis in Patients with Malignant Pleural Effusions

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ABSTRACT

Background: Malignant pleural effusions (MPE) are a pathological build-up of fluid and cancer cells within the pleural space. Patients have a significantly impaired quality and quantity of life, as this condition usually indicates an advanced disease. Video-assisted thoracoscopic (VATS) pleurodesis is a minimally invasive and effective treatment modality for patients with MPE.

Material and Methods: We conducted a retrospective study of 60 patients with MPE treated with VATS pleurodesis. Success rates within a one-month follow-up, the intensity of dyspnea, Karnofsky and ECOG Performance Status Scales before and after the procedure, and length of hospital stay were observed.

Results: VATS pleurodesis had a high success rate at the end of a one-month follow-up. A statistically significant difference was observed regarding the intensity of dyspnea, Karnofsky, and ECOG Performance Status before and after VATS pleurodesis. The average length of hospital stay was 7.5 days for these patients.

Conclusion: Video-assisted thoracoscopic (VATS) pleurodesis is associated with low morbidity and a high success rate and is a reliable treatment modality for patients with MPE.

Keywords: pleural effusion, Video-Assisted Thoracic Surgery, pleurodesis, malignant

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Introduction

Malignant pleural effusions (MPEs) are the second most common type of exudative effusions within the pleural space. Approximately 200,000 patients in the USA, 50,000 patients in the UK, and 100,000 patients across Europe per year suffer from MPI secondary either to direct extension of cancer cells into the pleural cavity or inflammation induced by a malignant tumor¹. Lung adenocarcinoma and breast cancer account for more than half of all cases of MPE².

Patients with MPE are usually treated symptomatically, since this type of effusion usually indicates an advanced disease. In these cases, chemotherapy seems to be generally less effective. Dyspnea is the most common symptom attributable to the effusion, found in more than half of cases. Patients may also present with a non-productive, dry cough, and chest pain due to the involvement of the sensory neurons on the parietal pleura³. The assessment of the general physical condition of the patient and performance status in daily activities, i.e. the degree of functional impairment, are evaluated using the Karnofsky Performance Scale Index and the ECOG Performance Status Scale.

A diagnostic pleural tap (thoracentesis) with fluid analysis according to Light's criteria should be the first diagnostic tool to distinguish between transudative and exudative pleural effusion. Exudative effusions are commonly caused by an underlying malignancy, and rarely by an infection, pulmonary embolism, or gastrointestinal disease. However, in some rare cases, malignant effusions can also be transudative, depending on the underlying condition, and due to either increased hydrostatic or low oncotic pressure⁴.

Currently, there are several treatment options available for patients with significantly disabling MPE. Consecutive thoracenteses, with the removal of up to 1.5 liters of effusion, are sometimes performed for short-term management of MPE. If the MPE reoccurs, reasonable long-term modalities include chest tube placement, with the instillation of talc slurry, as well as either open or endoscopic, i.e. Video-Assisted Thoracic Surgery (VATS), chemical pleurodesis. Sclerosing agents that are used as chemicals include: talc,

tetracyclines, silver nitrate, iodopovidone, autologous blood, cisplatin, etc.

According to the post-procedure radiographic resolution of pleural effusion, as seen on a chest X-ray (CXR), the effectiveness or success of chemical pleurodesis can be either complete, partial, or failed pleurodesis. Successful pleurodesis is defined as the continued absence of re-accumulation of pleural fluid during a follow-up period of 30 days⁵.

Material and methods

The study was designed as a retrospective, single-center cohort study of 60 patients with MPE treated with VATS pleurodesis (using either Vibramycin or Talk suspension/powder) within two years at the Clinic for Thoracic Surgery, of the University of Sarajevo Clinical Center. The basic sample consisted of all patients with MPE, treated with VATS pleurodesis, in whom malignancy was determined by a cytology exam of the pleural fluid.

For patients of both genders and over 18 years of age, who had had a recurrent malignant pleural effusion, a Karnofsky Performance Scale Index score equal or greater than 50, predicted life expectancy of at least more than one month, and better subjective and overall condition after the initial thoracic intervention (pleural tap or tube thoracostomy), were included in the study.

On the other hand, the exclusion criteria were: patients who had a Karnofsky Performance Scale Index score lower than 50, poor general condition associated with a predicted life expectancy of less than one month, patients with pleural empyema and visceral pleura thickening, or the inability to achieve complete lung reexpansion and contact between the visceral and parietal pleura due to the existing lung disease, pregnancy, and previous exposure to radiation therapy.

The sclerosing agents used as chemicals for pleurodesis were a suspension of five grams of talc, or five grams of purified, asbestos-free, talc powder (particle size >15 µm), or 1000 to 1500 mg doxycycline, which were

administered to patients during the VATS procedure under general anesthesia.

Patient data included in this study were collected using the medical history of each patient. Categorical variables were expressed as counts and percentages. Independent t-tests were performed to compare the means of the continuous variables with normally distributed data. Alternatively, the Wilcoxon signed-rank test was performed to compare matched paired samples. Statistical analysis was performed using the MedCalc V.12.6.1.0. A p-value less than 0.05 ($p<0.005$) was considered statistically significant.

Results

A total of 19 (32%) male and 41 (68%) female patients were included in this study. The mean age was 60.42 ± 10.39 . The youngest patient was 31 years old

and the oldest was 80 years old. The most common type of primary tumor associated with the MPE was breast cancer, found in 20 patients (33%), followed by lung and pleural tumors in 13 patients (22%), and lymphomas in nine patients (15%).

The average length of hospital stay for patients treated with VATS pleurodesis was 7.52 ± 1.41 days (ranging from seven to 13 days). VATS pleurodesis was successful in 57 patients (95%) included in our study, whereas partial success was observed in the remaining five patients (5%), observed within 30 days of follow-up.

With the application of the Student's t-test for dependent samples, a statistically significant difference was determined in the value of the Karnofsky Performance Scale Index before and after VATS pleurodesis ($t = 18.05$, $p<0.0001$) (Table 1).

Table 1. Inferential statistics for paired samples t-test: Karnofsky Performance Scale

Karnofsky Performance Scale Index	Before VATS pleurodesis	After VATS pleurodesis
Sample size	60	60
Arithmetic mean	68.0000	82.5000
95% CI for the mean	65.5378 to 70.4622	79.6612 to 85.3388
Variance	90.8475	120.7627
Standard deviation	9.5314	10.9892
Standard error of the mean	1.2305	1.4187

Paired samples t-test

Mean difference	14.5000
Standard deviation	6.2232
95% CI	12.8924 to 16.1076
Test statistic t	18.048
Degrees of Freedom (DF)	59
Two-tailed probability	P < 0.0001

Using the Wilcoxon matched pairs test for dependent samples, a significant difference was observed regarding the intensity of dyspnea before and after VATS pleurodesis ($Md=4.00$ vs $Md=1.00$, $z=6.736$, $p<0.0001$) (Table 2).

Table 2. Inferential statistics for the Wilcoxon matched pairs test: Dyspnea

Dyspnea	Before VATS pleurodesis	After VATS pleurodesis
Sample size	60	60
Lowest value	<u>2.0000</u>	<u>0.0000</u>
Highest value	<u>5.0000</u>	<u>3.0000</u>
Median	4.0000	1.0000
95% CI for the median	4.0000 to 4.0609	0.0000 to 1.0000
Interquartile range	4.0000 to 5.0000	0.0000 to 1.0000

Wilcoxon test (paired samples)

Number of positive differences	0
Number of negative differences	60
Large sample test statistic Z	6.735867
Two-tailed probability	P < 0.0001

The Wilcoxon signed-rank test for dependent samples showed a statistically significant difference regarding the ECOG Performance Status Scale in patients before and after VATS pleurodesis (Md=3.00 vs Md=1.00, z=6.780, p<0.0001) (Table 3).

Table 3. Inferential statistics for the Wilcoxon matched pairs test: ECOG Performance Status Scale

ECOG Performance Status Scale	Before VATS pleurodesis	After VATS pleurodesis
Sample size	60	60
Lowest value	<u>1.0000</u>	<u>0.0000</u>
Highest value	<u>4.0000</u>	<u>2.0000</u>
Median	3.0000	1.0000
95% CI for the median	3.0000 to 3.0000	0.0000 to 1.0000
Interquartile range	2.0000 to 3.0000	0.0000 to 1.0000

Wilcoxon test (paired samples)

Number of positive differences	0
Number of negative differences	60
Large sample test statistic Z	6.679959
Two-tailed probability	P < 0.0001

Discussion

Pleurodesis is a procedure that aims to obliterate the pleural space in patients where air or recurrent and excessive intrapleural fluid with cancer cells may build up. In our study, breast cancer was the most common

type of primary tumor associated with the MPE, observed in a third of our patients. A single-center, retrospective study by Hirata et al., demonstrated that breast cancer was the second-ranking cause of MPE, with up to 11% of these patients having MPE during their disease⁶.

MPE gives rise to dyspnea, cough, and chest pain, which leads to a reduced activity level and an overall decrease in quality of life. VATS pleurodesis with sclerosing agents provides reliable and effective palliation of malignant pleural effusion, with high success rates. Every patient in our study who underwent VATS pleurodesis had either a complete (57 patients, 95%) or partial success (three patients, 5%), i.e. resolution of symptoms, within a one-month follow-up. Earlier prospective studies by Musch et al. and Van Belle et al. demonstrated a 30-day success rate of 75% and 91% in patients with breast cancer and MPEs treated with VATS pleurodesis^{7,8}. One recent retrospective, single-center study of 135 patients with MPE, treated with VATS (talc) pleurodesis, showed a somewhat similar result: 78.4% of patients were pleural effusion-free at a one-month follow-up⁹.

The mean length of stay for our patients was 7.5 days, whereas some studies reported a prolonged stay of up to 10.4 days - mostly due to post-operative air space, air leak, empyema, and prolonged intercostal catheter drainage¹⁰. The most common postprocedural complications in our patients, which may be attributed to the prolonged duration of stay, were as follows: accidental removal of a chest tube in three patients (5% of cases), fever in two patients (3.3% of cases), and procedure-related acute respiratory failure and chest pain in two patients (3.3% of cases).

Quality and quantity of life are significantly impaired in patients with MPEs, and proper control and alleviation of symptoms is the primary goal of care in these patients. In our study, the Karnofsky and ECOG Performance Status Scales, and the intensity of dyspnea showed statistically significant differences before and after pleurodesis. A retrospective analysis of a database collected prospectively from June 2004 to July 2014 by Mingarini Terra et al. showed that after VATS pleurodesis, there was a significant improvement in respiratory symptoms, physical domain, and the general health of patients compared to the preprocedural state¹¹.

Conclusion

VATS pleurodesis is associated with low morbidity and a high success rate, especially within the first month after the procedure. It is a generally safe and reliable, minimally invasive option in a selected group of patients, that significantly reduces hospital stay, improves the patients' general condition, and alleviates debilitating symptoms, especially dyspnea.

Conflict of interests

The authors have no relevant financial or non-financial interest to disclose.

Patient Consent Form: All participants were informed about subject of the study.

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