Risk Factors Affecting Spontaneous Pleurodesis After Indwelling Tunneled Catheter Application in Malignant Pleural Effusion

Malign Plevral Efüzyonda Kalıcı Tünelli Kateter Uygulanma Sonrası

Spontan Plörodezisi Etkileyen Risk Faktörleri

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Objective: Spontaneous pleurodesis with indwelling tunneled catheter (ITC) in malignant pleural effusions has a very important role in the improvement of dyspnea and quality of life of patients. Our aim in this study was to determine the efficacy of indwelling tunneled catheterization in malignant pleural effusion and the risk factors affecting the occurrence of spontaneous pleurodesis.

Materials and Methods: The study included 34 patients who underwent ITC for malignant pleural effusion in our thoracic surgery clinic between August 2020 and August 2022. Demographic data of the patients, primary malignancy, pleural procedures performed for malignant pleural effusion, indication for ITC, serum albumin level before ITC, duration of hospitalization, complications related to ITC and post-discharge follow-up were recorded.

Results: The underlying primary malignancy of the 34 patients included in the study was metastatic lung cancer in 18 patients, breast cancer in 6 patients, colon cancer in 5 patients, mesothelioma in 3 patients and malignant melonoma in 2 patients. There was a statistically significant correlation between the absence of an entrapped lung, the short interval between the onset of malignant pleural effusion and the application of ITC, the absence of a history of massive effusion, and the length of time to terminate ITC and the success of spontaneous pleurodesis.

Conclusion: In the occurrence of spontaneous pleurodesis, the presence of an entrapped lung, the presence of massive effusion, the time between the onset of malignant pleural effusion and the application of ITC, and the duration of termination of ITC are important risk factors.

Key words: Malign pleural effusion, indwelling tunneled catheter, spontaneous pleurodes

Amaç: Malign plevral efüzyonlarda kalıcı tünelli kateter ile spontan plörodezis oluşması hastaların nefes dağrılığı ve hayat kalitesinin düzelmesinde çok önemli bir role sahiptir. Bu çalışmadaki amacımız malign plevral efüzyonda kalıcı tünelli kateter (KTK) uygulanmasının etkinliği ve spontan plörodezisin oluşumunu etkileyen risk faktörlerini saptamaktır.

Materyal ve Metod: Çalışmaya Ağustos 2020 ile Ağustos 2022 tarihleri arasında göğüs cerrahi kliniğimizde malign plevral efüzyon nedeniyle KTK uygulanan 34 hasta dahil edildi. Hastaların demografik verileri, primer malignite, malign plevral efüzyon için uygulanan plevral işlemler, KTK uygulanma endikasyonu, KTK uygulanma öncesi serum albümin seviyesi, hastane yatış süresi, KTK'ya bağlı komplikasyonlar ve taburculuk sonrası takipler kayıt altına alındı.

Bulgular: Çalışmaya dahil edilen 34 hastanın altta yatan primer malignitesi; 18 hastada metastatik akciğer kanseri, 6 hastada meme kanseri, 5 hastada kolon kanseri, 3 hastada mezotelyoma ve 2 hastada ise malign melonom idi. Tuzaklanmış akciğer yokluğu, malign plevral efüzyonun ortaya çıkmasıyla KTK uygulanması arasındaki sürenin azlığı, masif efüzyon hikayesinin yokluğu ve KTK'nın sonlandırılma süresisinin uzunluğu ile spontan plörodezis başarısı arasında istatistiksel olarak anlamlı ilişki vardı.

Sonuç: Spontan plörodezisin oluşumunda tuzaklanmış akciğer varlığı, masif efüzyon varlığı, malign plevral efüzyonun ortaya çıkması ile KTK uygulanması arasındaki süre ve KTK'nın sonlandırılma süresi önemli risk faktörleridir.

Anahtar kelimeler: Malign plevral efüzyon, kalıcı tünelli kateter, spontan plorödezis

INTRODUCTION

Malignant pleural effusion (MPE) occurs in more than 50% of patients with advanced lung cancer. It may also occur as a result of metastasis of extrapulmonary cancers to the pleura (Shaw & Agarwall., 2004). MPE causes severe dyspnea and decreased quality of life in patients. Traditional treatment options for MPE include thoracentesis, chest tube drainage, chemical and surgical pleurodesis (Roberts et ai., 2010). However, MPE frequently recurs and requires repeated thoracentesis or chest tube drainage (de Andrade., 2015). Chemical pleurodesis via chest tube may require prolonged hospitalization and despite initial success, MPE often recurs after several months (Penz et al., 2014). Surgical pleurodesis is often too invasive for cancer patients (Bhatnagar et al., 2015). The MPE guideline of the British Thoracic Society reports that the Indwelling Tunneled Catheter (ITC) is a treatment modality for the malignant pleural effusion in patients with an estimated survival of more than 1 month with an entrapped lung or recurrent pleural effusion despite chemical pleurodesis (Roberts et al., 2010).

Van Mater et al. (2011) demonstrated that ITC is a safe approach in the treatment of MPE and no complications were observed in 87.5% of patients. ITC may cause obliteration in the pleural space in patients with advanced cancer and lead to spontaneous pleurodesis (SP). Obtaining spontaneous pleurodesis may lead to removal of the ITC. The rate of SP in MPE patients has been reported to be 45.6% and was achieved after a mean period of 26 to 56 days after placement of the ITC (Van Mater et al., 2011; Bertolaccini et al., 2012; Scheinder et al., 2009; Al-Halfawy & Light., 2008; Bazerbashi et al., 2009; Ohm et al., 2003). Many factors affect the occurrence of spontaneous pleurodesis in patients with indwelling tunneled catheters. Our aim in this study was to determine the efficacy of indwelling tunneled catheter placement in malignant pleural effusion and the factors affecting the occurrence of spontaneous pleurodesis.

MATERIAL and METHOD

The study included 34 patients who underwent ITC for malignant pleural effusion in our thoracic surgery clinic between August 2020 and August 2022. The study was planned as a retrospective cohort study. The study was conducted in accordance with the Declaration of Helsinki 2008 Principles. The study protocol was approved by the Institutional Ethics Committee (date:07.09.2023 number:34028104-799). Clinical, radiologic and laboratory findings of all patients until August 2023 were obtained from the hospital automation system and archive files.

Demographic data, primary malignancy, pleural procedures performed for malignant pleural effusion, indication for ITC, serum albumin level before ITC, duration of hospitalization, complications related to ITC and post-discharge follow-up were recorded. Pleural effusion was defined as massive effusion if it was more than two-thirds of the hemithorax. Entrapped lung was defined as failure to achieve adequate reexpansion on chest radiography despite adequate drainage and negative aspiration. Spontaneous pleurodesis was defined as drainage of less than 100 ml for at least 3 days in patients who underwent ITC and no reoccurrence of effusion after termination of ITC.

ITC was implanted in patients with entrapped lung, or in patients who had previously undergone chemical pleurodesis and failed, or in patients with high-flow drainage from the drainage catheter (Figure 1). ITC was placed in the operating room under sedation and local anesthesia (Figure 2). Failure of spontaneous pleurodesis was defined as occlusion of the ITC, significant localization in the pleural space, or premature termination of ITC for any reason. Gender, age, presence of entrapped lung, primary tumor originating from the lung, time between the onset of malignant pleural effusion and ITC, history of chemical pleurodesis, serum albumin level before ITC, time to termination of ITC, and history of massive effusion were examined for statistically significant correlations with spontaneous pleurodesis success.

Statistical Evaluation of Data

IBM-Statistical Package for Social Sciences (IBM-SPSS Inc., Chicago, IL, USA) 20.0 program was used to analyze the data obtained in the study. Chi-square test was used to compare categorical variables in statistical analyses. Mann-Whitney U test was used to compare continuous variables between two groups. In summarizing the results of the study, frequency frequencies and percentages were used as descriptive statistics for categorical variables and median (min. - max.) was used for continuous variables. In the study, $p<0.05$ was taken as the limit of statistical significance.

Figure 1. Indwelling tunneled catheter

Figure 2. Permanent tunneling pleural catheter placed by subcutaneous tunneling in the patient

RESULTS

The underlying primary malignancy of the 34 patients included in the study was metastatic lung cancer in 18 patients, breast cancer in 6 patients, colon cancer in 5 patients, mesothelioma in 3 patients and malignant melonoma primary malignant tumor in 2 patients. The reasons for ITC were entrapped lung in 18 patients, recurrent effusion despite previous drainage and chemical pleurodesis in 11 patients, and high-flow drainage in 5 patients. Clinical and radiological characteristics of the patients are summarized in Table 1.

Table 1. Clinical and radiologic characteristics of the patients

Variable	n
Gender (Male/Female)	19/15
Age (years)	67±13
Primary tumor (Lung/non-lung)	18/16
Trapped lung (present/absent)	18/16
History of chemical pleurodesis (yes/no)	11/23
History of massive pleural effusion (present/absent)	21/13
Time between the onset of malignant effusion and ITC administration (weeks)	12±5
Duration of termination of ITC (weeks)	29±9
Serum albumin level before ITC administration (low/normal)	12/22

Patients were discharged a mean of 2.2 ± 0.6 days after ITC. Outpatient clinic visits were performed at 10-day intervals for the first 3 months and at 15-day intervals thereafter. Drainage amounts were asked to be noted daily. The mean follow-up period was 10.4 ± 4.1 months.

ITC-related complications were seen in 10 patients. Wound infection was seen in 4 patients and treated with oral antibiotics. Tumor implantation occurred in the ITC tract in 1 patient who underwent ITC for mesothelioma, and drainage was continued in the patient who underwent local radiotherapy. Loculated effusion developed in 2 patients. Intrapleural fibrinolytics were administered, but success was achieved in 1 patient. ITC was terminated in 3 patients due to complications. The cause was empyema in 2 of these patients and chronic cough due to catheter irritation of the right oblique fissure in 1 patient. Spontaneous pleurodesis could not be achieved in 9 patients. The reasons for this were the development of effusion again after termination of ITC in 3 patients, early termination of ITC in 4 patients due to complications (2 empyema, 1 loculated effusion, 1 chronic cough) and 2 patients died during the follow-up of ITC.

There was a statistically significant correlation between the absence of an entrapped lung (p=0.010), the short interval between the onset of malignant pleural effusion and the application of ITC (p=0.000), the absence of a history of massive

effusion (p=0.025), and the length of time between the termination of ITC (p=0.045) and the success of spontaneous pleurodesis. There was no significant relationship between other parameters and spontaneous pleurodesis (p>0.5).

DISCUSSION

In malignant pleural effusions, ITC is a method that allows drainage of the pleural space, lung expansion and ultimately spontaneous pleurodesis. It is a successful method that can be inserted under local anesthesia and allows outpatient follow-up. Patients with entrapped lung, low performance score and short survival are the most suitable candidates for treatment with ITC (Tremblay et al., 2007). ITC placement is considered to be a relatively safe procedure and no complications are observed during the procedure in an average of 87.5% of patients (Van Meter et al., 2011). Complications reported in the literature include local pain (0.4-13%), bleeding (0-0.9%), pneumothorax (0-38%), cellulitis at the wound site (1.3-25%), pleural infection (0-16%. 7%), asymptomatic localizations (4-7.3%), symptomatic localizations (2-13.5%), ITC tract metastasis (0-13.6%), occluded catheter (0-17.6%), ITC dislodgement (1.3-17.7%) and ITC fracture during removal (9.8%). Studies show that 20.6% (range, 1.6-20.6%) of ITCs require removal due to complications (Tremblay et al., 2007 ; Davies et al., 2012; Fysh et al., 2012; Sioris et al., 2009; Tremblay et al., 2006; Fysh et al., 2012).

Complications developed in 10 of 34 patients (29.4%) in our study. Empyema, a serious complication, was seen in two patients (5.8%), and empyema was successfully treated with antibiotics after ITC was terminated. The TIME 2 study reported that the risk of pleural infection was 13.4% in the ITC group and 1.9% in the talc pleurodesis group (Tremblay et al., 2007). Chemotherapy is not considered a contraindication for ITC and vice versa. No increase in the risk of pleural infection was observed in patients receiving chemotherapy while the ITC was implanted. 24 Symptomatic localizations following ITC placement are a relatively important complication, as they often require hospitalization for treatment such as intrapleural fibrinolysis or other pleural procedures.

We found that the presence of an entrapped lung, a history of massive pleural effusion, a shorter time from the first appearance of malignant pleural effusion to ITC placement, and a longer time from ITC placement to the patient's death or the end of the study were associated with SP. Entrapped lung is a factor that has a negative impact on the occurrence of spontaneous pleurodesis. However, it has been observed that patients who underwent ITC for entrapped lung can still achieve SP or the lung can expand after ITC (Scheinder et al., 2009; Al-Halfawy & Light., 2008; Ohm et al., 2003; Sioris et al., 2009; Warren et al., 2008). In our study, the underlying cause was entrapped lung in 5 of 9 patients in whom spontaneous pleurodesis could not be achieved. Spontaneous pleurodesis was achieved in 13 of the 18 patients in the study who underwent ITC because of entrapped lung.

In our study, we found that a shorter time from the first appearance of malignant pleural effusion until the insertion of the ITC had a positive effect on the occurrence of spontaneous pleurodesis. This shows us that the earlier the ITC is inserted in malignant pleural effusions, the better the chances of success. Studies have shown that it is difficult to cope with malignant pleural effusion in case of failure of chemical pleurodesis (Fysh et al., 2015). On the contrary, we found no significant correlation between history of chemical pleurodesis and spontaneous pleurodesis in our study. However, since our study is a small case series including 34 patients, larger studies are needed.

CONCLUSION

ITC is a safe method with few complications in obtaining spontaneous pleurodesis in malignant pleural effusions. The presence of an entrapped lung, the presence of massive effusion, the time between the onset of malignant pleural effusion and the application of ITC, and the duration of termination of ITC are important factors in the occurrence of spontaneous pleurodesis. Since achievement of spontaneous pleurodesis and termination of ITC will improve the quality of life in patients with advanced malignancy, further studies with more cases are needed on the factors affecting the success of spontaneous pleurodesis.

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