

The safety and efficiency of pericardial window by using uniportal video-assisted thoracoscopic surgery for the treatment of pericardial effusion: A single-center experience

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ABSTRACT

Introduction: Pericardial window (PW) is a surgical procedure in which a part of the pericardium is removed so that the effusion can flow into the chest cavity. Our study aims to analyze a series of patients with chronic recurrent and/or large pericardial effusions who underwent single-port video-assisted thoracoscopic surgery (VATS)-PW opening. The uniportal method seems to be a better option because it is performed with small cosmetic incisions and is less painful.

Materials and Methods: Thirty-six patients were referred to our clinic with recurrent, chronic, and/or large PE between March 2019 and May 2022. All patients were analyzed for gender, age, body mass index (BMI), symptom, operation side, discharge time, complications, and pathologic specimens.

Results: Of the 35 patients, 25 (71.4%) were male, 10 (28.6%) were female, and the mean age was 60.1 ± 15.4 years. The left side was preferred for 28 patients (80%) and the right for 7 (20%). The median BMI was 25.5 kg/m^2 (24.0–28.1). The median day of stay in our clinic and/or referred clinic where they are followed up due to comorbidities was 1 (1–2). Four patients (11.4%) who were previously diagnosed with malignancy and whose pericardial biopsy was compatible with the primary disease died within the 1st month postoperatively. The mortalities were not attributed to the pericardial procedure.

Conclusion: PW opening using uniportal VATS seems to be a safe method for patients with PE without needing one-lung ventilation. In addition, uniportal VATS can be considered the first surgical option in obese patients.

Keywords: Pericardial effusion, Uniportal, Video-assisted thoracoscopic surgery

Introduction

Pericardial effusion (PE) is an acute or chronic accumulation of fluid in the pericardial sac. In a healthy individual, the pericardium contains between 15 and 50 mL

of serous fluid. PE is the accumulation of over 50 mL of fluid in the pericardial cavity. Pathologies that can cause increased production or impaired fluid absorption in the pericardium result in PE, which can lead to clinical condi-



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tions ranging from asymptomatic cases to life-threatening cardiac tamponade.^[1]

Pericardial window (PW) is a surgical procedure in which a part of the pericardium is removed so that the effusion can flow into the chest cavity. This procedure prevents the mass effect caused by recurrent PE (usually malignant). Another advantage is that it will provide a definitive treatment by limiting the occurrence of PE and/or tamponade.^[2]

Subxiphoid fenestration, PW opening with thoracotomy, and PW opening with video-assisted thoracoscopic surgery (VATS) are the three surgical methods used to treat PE.^[3]

For the last two decades, surgeons have been inclined to open PW from a single port instead of traditional VATS.^[4] The uniportal method seems to be a better option because it is performed with small cosmetic incisions and is less painful. This method is gaining popularity among thoracic surgeons. In this single-center study, we aimed to present the reliability and long-term results of uniportal VATS-PW.

Materials and Methods

Thirty-six patients were referred to our clinic with recurrent, chronic, and/or large PE between March 2019 and May 2022. Patient records were evaluated retrospectively after the approval of the local ethics committee (decision number: 2022/15/639).

Thirty-five of 36 patients operated on using uniportal VATS for PW were enrolled in the study. One patient under the age of 18 was excluded from the study.

All patients were analyzed for gender, age, body mass index (BMI), symptom, operation side, discharge time, complications, and pathologic specimens.

Pre-operative thoracic computed tomography was used to determine other chest pathologies and the operation side. The localization and amount of PE within the pericardial sac determined by pre-operative transthoracic echocardiography (TTE) were used to choose the level of the intercostal incision. Based on those views, mid-axillary line 4, 5, or 6 intercostal spaces were preferred.

The patients were placed in the supine position, and the operation side was elevated to 30°. A 2.5 cm incision was performed from the mid-axillary line at the junction of the pre-determined intercostal space. Access to the chest cavity was achieved by using electrocautery. A 10 mm 30°

video thoracoscope was inserted through the trocar. The trocar was retracted. If the patient also had a pleural effusion, it was drained before PE. After identifying and protecting the phrenic nerve, PE was evacuated by performing pericardiotomy on the surface of the pericardium with an L-hook cautery. Samples were taken from the effusion for cytologic and microbiological examination.

The pericardium, whose tension was reduced, was grasped with an endo-grasper. The pericardiotomy incision was widened with a 5 mm surgical energy device (Fig. 1), and a biopsy was taken by opening a window of just about 4 cm² from the detected pathological areas (Fig. 2). Then, the pleural space, lung parenchyma, and mediastinum were evaluated. After the bleeding control, a 24F chest drain was placed into the thoracic cavity through the utility incision and connected to the underwater sealed drainage system.

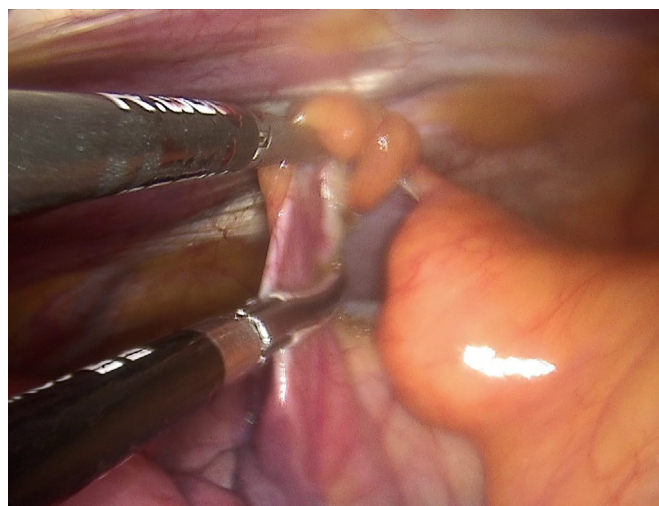


Figure 1. Window created by surgical energy device.

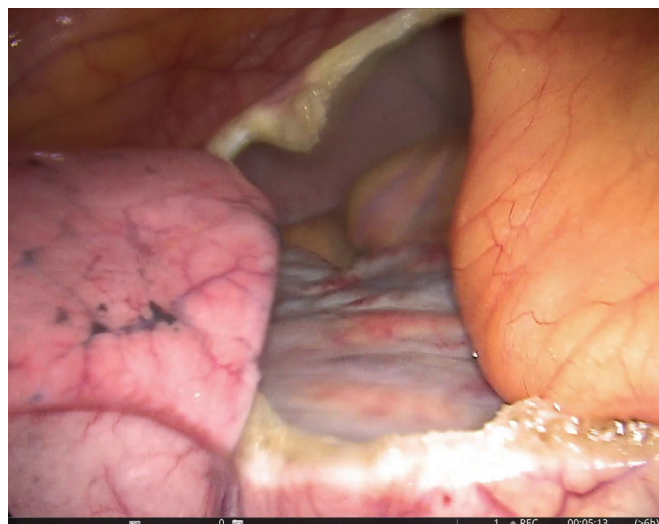


Figure 2. Pericardial window created with pericardiotomy.

A chest X-ray was taken on the first post-operative day, and TTE was performed. The drain of the patients without air leakage was removed.

Patients with additional clinical situations were referred to their relevant clinics for follow-up.

Other patients were discharged at 24 h for outpatient control after 10 days. Operative mortality was defined as mortality within 30 days after surgery.

Statistical Analysis

The IBM® SPSS® (Statistical Package for the Social Sciences) version 22 (IBM Corp., Armonk, NY, USA) software was used for statistical analysis. Qualitative data were presented as frequency and percentage. The patient's BMI and length of stay in the hospital showed non-normal distribution according to the Shapiro–Wilk test and were given as median (interquartile range [IQR]). Age was presented as the mean±SD with a normal distribution.

Results

The data on patients' gender, operation side, and type of intubation are detailed in Table 1, and the mean and median values are given in Table 2.

Of the 35 patients, 25 (71.4%) were male, 10 (28.6%) were female, and the mean age was 60.1±15.4 years. The left side was preferred for 28 patients (80%) and the right for 7 (20%). The median BMI was 25.5 kg/m² (24.0–28.1). All patients presented with dyspnea, and three patients had a fever in addition to this symptom.

The median day of stay in our clinic and/or referred clinic where they are followed up due to comorbidities was 1 (1–

Table 1. Data on patients' gender, operation side, and type of intubation

Variables	
Gender	25 male (71.4%), 10 female (28.6%)
Operation side	28 left (80%), 7 right (20%)
Type of intubation	11 OLV (31.4%), 10 DLV (28.6%), 14 NE (40%)

OLV: One-lung ventilation; DLV: Double-lung ventilation; NE: Non-entubated.

Table 2. Data on patients' age, BMI, and length of stay in the clinic

Variables	
Age, years	60.1±15.4
BMI (kg/m ²)	25.5 (24.0–28.1)
Stay in clinic, days	1 (1–2)

BMI: Body mass index.

2). Four patients (11.4%) who were previously diagnosed with malignancy and whose pericardial biopsy was compatible with the primary disease died within the 1st month postoperatively. The mortalities were not attributed to the pericardial procedure.

There was no microbial growth in the culture samples of 35 patients. Histopathological diagnoses were reported as chronic non-specific inflammation in 21 patients (60%), hyalinization in 3 (8.5%), malignancy in 9 (25.7%), and acute inflammation in 2 (5.7%). In patients whose pericardial biopsy was reported as chronic inflammation, mediastinal lymph node biopsy was reported as carcinoma metastasis in one patient. In addition, one of the pleural biopsy results was also compatible with carcinoma metastasis.

Pericardial fluids were checked by performing TTE on the wound site on the 10th post-operative day. Pericardial fluid accumulation and any post-operative complications were not observed. The median follow-up period of the patients was 385 (322–485) days. We did not encounter any recurrence of PE.

Discussion

Surgical intervention for the treatment of PE is still the gold standard. VATS is superior to open surgical interventions for post-operative pain both in the short and long term. In addition, a single incision in VATS will lead to less paresthesia, less morbidity, and faster recovery.^[5] Studies on uniportal VATS have supported this hypothesis.^[6,7]

From this point of view, it can be thought that opening PW with uniportal VATS, which constitutes the main idea of our study, will achieve similar success rates compared with open surgery. In our study, we aimed to compare uniportal VATS-PW results with other surgical methods in light of the literature.

PW is usually performed by cardiac surgeons, and conventional surgery is preferred.^[8,9] The subxiphoid approach remains the gold standard for PW.^[10] This technique is preferred because the procedure can be performed under sedation and/or local anesthesia.^[11,12] The main disadvantage of this technique is not considering a true PW since it does not allow the transition of the pericardial space to the pleural space.^[13] Another disadvantage is that the pericardial space cannot be explored directly, and biopsy cannot be taken from accompanying intrathoracic pathologies. The anterior thoracotomy approach provides these possibilities, but the advantages of VATS mentioned above cannot be used. As a result, PW opening with a single-port VATS in PE may be more appropriate in terms of both its positive effects on the patients and the possibility of exploration and biopsy. The number of studies about this issue is very few in the literature. The uniqueness of our study is that PW can be opened with uniportal VATS without requiring single-lung ventilation, and even pleural and mediastinal sampling in concurrent pathologies can provide an important advantage. In addition, it offers ease of procedure in obese patients for whom open surgery is also difficult.

In the literature, single-lung ventilation is required for the VATS procedure. In cases where this condition is not met, the operation becomes almost impossible.^[14,15] A recent study^[3] reported that one-lung ventilation (OLV) is not required for open uniportal VATS-PW. We performed our procedure with OLV in 11 of the patients in our study. Of the remaining 24 patients, 10 were performed as double-lung ventilation and 14 as non-intubated. There was no surgical problem. Therefore, we consider that OLV is not exactly necessary for uniportal VATS-PW.

Adipose tissue in obese patients is a disadvantage for the subxiphoid approach.^[8,13] It has also been reported that it may be challenging to perform a mini-thoracotomy in obese individuals and women with large breasts.^[15] In our study, 7 (20%) patients were obese and morbidly obese. In women with large breasts, surgery was performed by pulling the breast to the opposite side. There was no problem for uniportal VATS-PW in these two patient groups.

The literature has reported that an incision of 5–8 cm is required for subxiphoid approach and anterior thoracotomy.^[9,14,15] In our procedure, the incision length for uniportal VATS was 2.5 cm. This suggests that uniportal VATS-PW is cosmetically advantageous.

In a study by Muhammed,^[14] the length of hospital stay after the surgery was obtained 12.3±22.6 days for subxiphoid approach and anterior thoracotomy while 10.2±12.1 days in the VATS group. Yesiltas et al.^[9] reported the length of hospital stay as median 2 (1–4) days. The median length of hospital stay in our study was 1 (1–2) either from our clinic or referral clinic, where they are followed up due to comorbidities.

The mortality rate was reported as 8 (14%) for subxiphoid approach^[13] and as 4 (8.33%) for anterior thoracotomy in the literature.^[15] In our study, 30-day mortality was detected in 4 (11.4%) patients, and it is seen to be similar when compared with other studies. The 30-day mortality in our study was not associated with surgery and was attributed to the aggressiveness of the underlying malignancy.

The PE recurrence rate after PW opening is reported between 1 % and 33% in the literature.^[12] In a study, Yesiltas et al.^[9] used subxiphoid approach and reported the recurrence rate as 9.4%^[11] in 142 patients. Five of them were re-operated. In another study, Balla et al.^[12] reported recurrence in 8 patients (17%), 2 patients needed both pericardiosynthesis and anterior thoracotomy.

Although the need for prolonged ventilation and narcotic use, anterior thoracotomy is still widely used because of the high recurrence rates of subxiphoid approach.^[8]

We did not detect any PE recurrence during the follow-up period for median 385 (322–485) days in our study.

Limitations

Our study has several limitations. First of all, it is a single-center retrospective study. Second, the number of patients is relatively low, and the comparison of all surgical procedures could not be performed.

Conclusion

PW opening using uniportal VATS seems to be a safe method for patients with PE without needing OLV. In addition, uniportal VATS can be considered the first surgical option in obese patients.

Disclosures

Ethics Committee Approval: Patient records were evaluated retrospectively after the approval of the local Ethics Committee (Decision number: 2022/15/639).

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Conflict of Interest: None declared.

Authorship Contributions: Concept – M.E.Ç.; Design – M.E.Ç.; Supervision – M.E.Ç., Ş.K.; Materials – M.E.Ç., Ş.K.; Data collection and/or processing – Ş.K.; Analysis and/ or interpretation – M.E.Ç., Ş.K.; Literature search – M.E.Ç., Ş.K.; Writing – M.E.Ç.; Critical review – M.E.Ç., Ş.K.

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