



# Percutaneous Balloon Pericardiotomy and Window Creation for Treating Recurrent Massive Pericardial Effusion in Patients with Cancer: A Case Series and Literature Review

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## Abstract

Cancer is the second leading cause of death worldwide, and pericardial effusion is relatively common in these patients. What constitutes the best therapeutic method for treating pericardial effusion in patients with cancer is controversial. Recent decades have witnessed the introduction of percutaneous balloon pericardiotomy, an effective and less-invasive method with lower recurrence rates than pericardiocentesis for draining pericardial effusion in patients with cancer who have a poor prognosis.

We herein describe 2 patients with a history of metastatic melanoma and metastatic breast cancer, presenting with symptomatic massive pericardial effusions. The patients had experienced 2 episodes of cardiac tamponade in the preceding 4 to 5 months, treated via surgical drainage. In their current episode, they were both successfully treated via percutaneous balloon pericardiotomy, and there was no recurrence of significant pericardial effusion reported during the follow-up.

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**Keywords:** Neoplasms; Pericardial effusion; Cardiac tamponade; Pericardiocentesis; Pericardiectomy

## Introduction

Cancer is the second leading cause of death worldwide and is expected to become the first in future decades.<sup>1</sup>

Although advances in diagnostic modalities and treatment options for cancer can lead to early diagnoses and improved outcomes, a new set of challenges has emerged in recent years. Increased lifespan of patients renders them more

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susceptible to cardiac complications or other illnesses during their lifetime.<sup>2</sup> Pericardial effusion is relatively common among patients with cancer (up to 21%) and could be caused by the direct invasion of the tumor to the pericardium or could be a side effect of chemotherapy or radiotherapy, the principal treatment options of cancer.<sup>3,4</sup> Pericardial effusion predominantly occurs in patients with advanced stages of cancer and is associated with a worse prognosis.<sup>3</sup>

What constitutes the optimal therapeutic method for treating pericardial effusion in patients with cancer is controversial and depends on the possibility of the recurrence of pericardial effusion and the patient's life expectancy. Pericardiocentesis and surgical drainage are commonly used techniques for treating pericardial effusion in symptomatic or hemodynamically unstable patients.<sup>3</sup> Surgical drainage is the most studied method and is introduced as a more definitive treatment for pericardial effusion, but its use is limited in patients with cancer due to their poor prognosis and the high risk of the procedure.<sup>4,5</sup> Pericardiocentesis is a less invasive and efficient technique with similar outcomes to the surgical method.<sup>6</sup> On the other hand, in patients with advanced cancer, the purpose of treatment should be focused on relieving the symptoms by using minimally invasive methods with acceptable safety.<sup>7</sup> Studies have revealed high recurrence rates in pericardiocentesis compared with other methods, including pericardiotomy.<sup>7</sup> In recent decades, percutaneous balloon pericardiotomy has been introduced as an effective, simple, and less invasive method with lower recurrence rates than pericardiocentesis for draining pericardial effusion in patients with cancer who have a poor prognosis.<sup>8</sup>

It is valuable to understand the significance of less invasive drainage techniques for patients with cancer who have an end-stage or poor prognosis presenting with symptomatic massive pericardial effusion with a view to improving their quality of life by relieving their symptoms. The current study aimed to evaluate the efficacy of percutaneous balloon pericardiotomy in patients with cancer presenting with massive pericardial effusions.

## Case Report

Written informed consent was obtained from the patients for the publication of this case report. The study complies with the Declaration of Helsinki and was approved by the Ethics Committee of Rajaie Cardiovascular Medical and Research Center (Ethics Committee Code: IR.RHC.REC.1401.037).

Percutaneous balloon pericardiotomy was performed under sedation and local anesthesia with lidocaine. The patients were hemodynamically stable during the monitoring. A subxiphoid approach was used to access the pericardial cavity. A spiral guidewire was inserted into the pericardial

cavity, and the local site was dilated with a 14F dilator before the passing of the balloon. A non-stretch Inoue balloon (26 mm for Case I and 30 mm for Case II) was sent over the wire, and the proper passing of the balloon through the skin was ensured and confirmed. Next, the Inoue balloon was inflated under the fluoroscopy guide until the appearance of a waist over it in the position of the parietal pericardium. Once the optimal position was achieved, the balloon inflation was continued until the waist could no longer be observed. Afterward, the fluid was drained into the pleural or subdiaphragmatic space. Finally, the balloon catheter was removed, and the pigtail was fixed under fluoroscopy. The pigtail catheter was removed the day after the procedure. The schematic and fluoroscopic images of the procedure are shown in Figure 1.

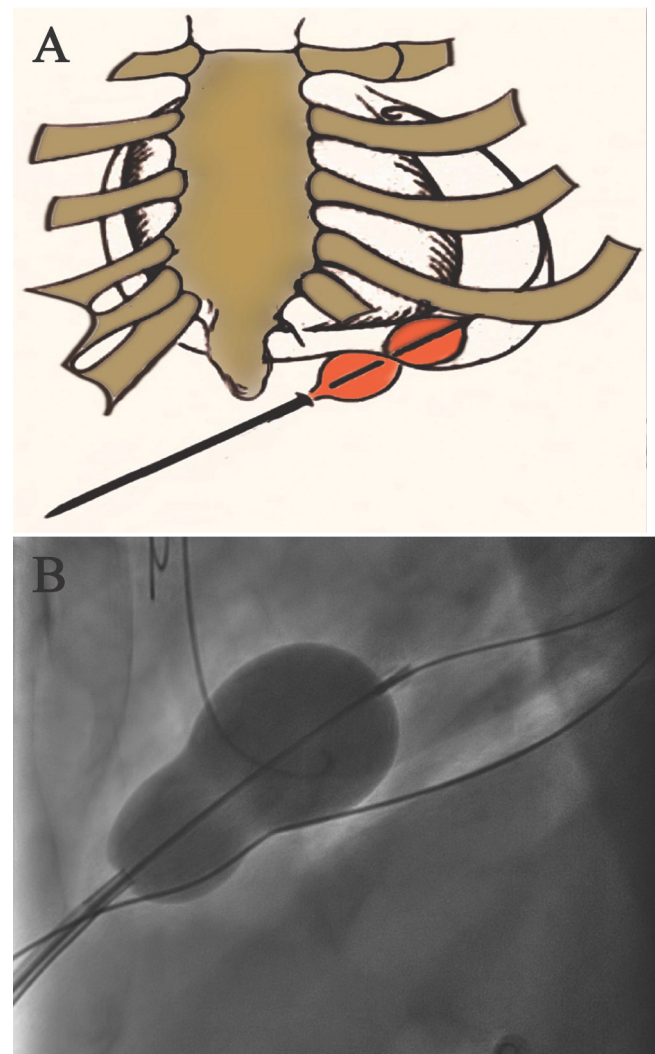


Figure 1. The schematic A) and fluoroscopic B) images of the percutaneous balloon pericardiotomy technique are presented herein. Balloon pericardiotomy via the subxiphoid approach was performed through the inflation of an Inoue balloon while it was located in the parietal pericardium until the waist appeared. Subsequently, the balloon inflation was continued until the waist could be no longer observed.

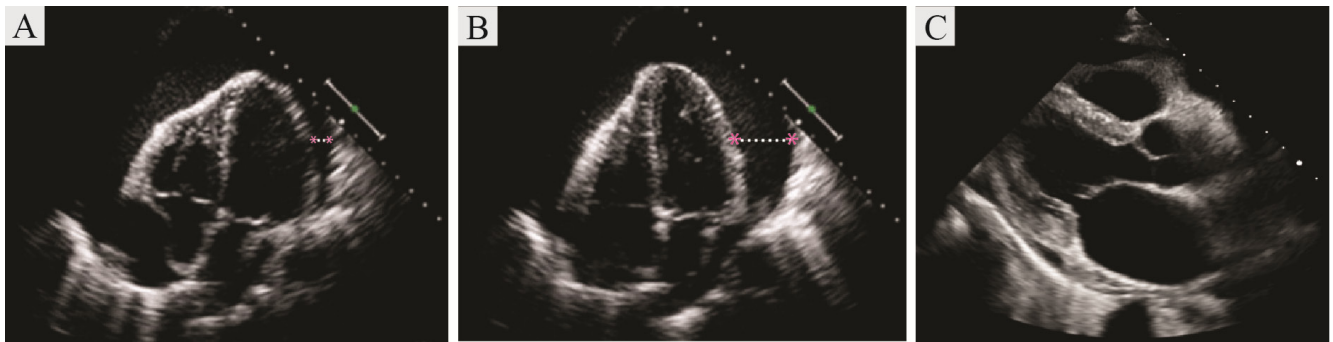


Figure 2. The images present the transthoracic echocardiography of Case II. A & B) The apical 4-chamber view demonstrates a sizable pericardial effusion and a swinging heart. C) The parasternal long-axis view demonstrates a mild pericardial effusion 2 months after the procedure.

### Case #1

A 42-year-old man with a history of metastatic melanoma was admitted to the hospital with dyspnea, orthopnea, and a massive pericardial effusion. The patient had been diagnosed with melanoma 4 years earlier, and despite receiving proper cancer treatment, he had a recent diagnosis of metastasis. During the preceding 5 months, he had experienced 2 episodes of cardiac tamponade, treated via surgical drainage. A physical examination in the emergency department revealed a heart rate of about 100 bpm and a systolic blood pressure of 90–95 mm Hg. His ECG demonstrated sinus tachycardia. Transthoracic echocardiography (TTE) illustrated a sizable circumferential pericardial effusion (maximum size=4 cm) on the lateral side of the left ventricle. Based on his history of metastatic melanoma and recurrent episodes of symptomatic massive pericardial effusions, the patient was treated via percutaneous balloon pericardiectomy after he provided informed consent. The procedure was performed as mentioned above. TTE was conducted during the procedure, 24 and 48 hours after the procedure, and once before hospital discharge. Pericardial effusion was observed in none of the echocardiograms. The patient underwent a stringent follow-up for 6 months postprocedurally, with TTE performed every 2 months. No recurrence of pericardial effusion was detected during the follow-up.

### Case #2

A 56-year-old woman with a history of metastatic breast cancer presented to the hospital with dyspnea and a massive pericardial effusion. She had experienced 2 episodes of cardiac tamponade during the preceding 4 months and had undergone surgical drainage. A physical examination in the emergency department revealed a heart rate of 100–110 bpm and a systolic blood pressure of 90–9 mm Hg. Her ECG showed sinus tachycardia and electrical alternans. TTE visualized a sizable circumferential pericardial effusion on the posterior side of the left ventricle (maximum size=4.3 cm) and a swinging heart (Figure 2). According to her

history of metastatic breast cancer and recurrent episodes of symptomatic massive pericardial effusions, the patient was treated via percutaneous balloon pericardiectomy after she granted informed consent. The procedure was performed as mentioned above. TTE was conducted during intraprocedurally, 24 and 48 hours postprocedurally, and once before hospital discharge. None of the echocardiograms showed pericardial effusion. She underwent a strict follow-up for 6 months following the procedure, with TTE performed every 2 months. The severity of her pericardial effusion did not exceed the mild level during the follow-up (Figure 2).

### Discussion

As the population ages and cancer incidence rises, we anticipate a growing prevalence of malignant pericardial effusion,<sup>9</sup> which may be linked to higher mortality rates. The survival rate of cancer cases with malignant pericardial effusion is estimated at 2 to 4 months; nonetheless, the rate can vary based on the underlying cancer. Lung neoplasms have the highest rate of pericardial involvement of all malignancies.<sup>7</sup>

Pericardial effusion can be treated via surgery, pericardiocentesis, or percutaneous balloon pericardiectomy. Surgical drainage can be associated with decreased life expectancy in patients with cancer due to lengthier hospitalization, increased risk of infection, or other perioperative complications. Recurrence of pericardial effusion is a known side effect of pericardiocentesis, which may occur in 13% to 50% of cases.<sup>10</sup>

In 1993, Ziskind et al<sup>10</sup> proposed the percutaneous balloon pericardiectomy technique as a minimally invasive method with lower recurrence rates. They performed this technique on 50 patients (44 cases with cancer and 6 with non-malignant causes) from 1987 through 1992 and reported successful outcomes in about 92% of the cases. Virk et al<sup>9</sup> compared the safety and efficacy of percutaneous interventions, including pericardiocentesis, percutaneous balloon pericardiectomy, and pericardial instillation of sclerosing agents, for treating



malignant pericardial effusion in a systematic review and meta-analysis in 2015. According to their study, the mortality rates of all percutaneous interventions were the same ( $\approx 0.5\%$ – $1\%$ ), and pericardiocentesis was associated with higher and more significant recurrence rates ( $\approx 38.3\%$ ) than other techniques. Their study also introduced percutaneous balloon pericardiomy as a highly effective method for treating patients with recurrent episodes of pericardial effusion.

We herein described 2 patients with a history of advanced metastatic cancer and recurrent massive pericardial effusions treated via percutaneous balloon pericardiomy, a minimally invasive method for draining the effusion and relieving the symptoms. The procedure was safely performed, with no complications or recurrence of significant pericardial effusions requiring hospitalization or treatment during a 6-month follow-up.

## Conclusion

Percutaneous balloon pericardiomy is a safe, simple, effective, and minimally invasive method for treating massive or symptomatic pericardial effusions in patients with cancer who have an end-stage or poor prognosis. It could also prevent frequent recurrences of pericardial effusion and, thus, decrease the hospitalization rate in this population.

## References

- Mattiuzzi C, Lippi G. Current Cancer Epidemiology. *J Epidemiol Glob Health* 2019;9:217-222.
- Paterson DI, Wiebe N, Cheung WY, Mackey JR, Pituskin E, Reiman A, Tonelli M. Incident Cardiovascular Disease Among Adults With Cancer: A Population-Based Cohort Study. *JACC CardioOncol* 2022;4:85-94.
- Ahmed T, Mouhayar E, Song J, Koutroumpakis E, Palaskas NL, Yusuf SW, Lopez-Mattei J, Hassan SA, Kim P, Cilingiroglu M, Marmagkiolis K, Vaporciyan AA, Swisher S, Deswal A, Iliescu C. Predictors of Recurrence and Survival in Cancer Patients With Pericardial Effusion Requiring Pericardiocentesis. *Front Cardiovasc Med* 2022;9:916325.
- El Haddad D, Iliescu C, Yusuf SW, William WN Jr, Khair TH, Song J, Mouhayar EN. Outcomes of Cancer Patients Undergoing Percutaneous Pericardiocentesis for Pericardial Effusion. *J Am Coll Cardiol* 2015;66:1119-1128.
- Shih CT, Lee WC, Fang HY, Wu PJ, Fang YN, Chong SZ. Outcomes of Patients with and without Malignancy Undergoing Percutaneous Pericardiocentesis for Pericardial Effusion. *J Cardiovasc Dev Dis* 2021;8:150.
- Besnard A, Raoux F, Khelil N, Monin JL, Saal JP, Veugeois A, Zannis K, Debauchez M, Caussin C, Amabile N. Current Management of Symptomatic Pericardial Effusions in Cancer Patients. *JACC CardioOncol* 2019;1:137-140.
- Labbé C, Tremblay L, Lacasse Y. Pericardiocentesis versus pericardiomy for malignant pericardial effusion: a retrospective comparison. *Curr Oncol* 2015;22:412-416.
- Irazusta FJ, Jiménez-Valero S, Gemma D, Meras P, Galeote G, Sanchez-Recalde A, Rial V, Moreno R, Lopez-Sendon JL. Percutaneous balloon pericardiomy: Treatment of choice in patients with advanced oncological disease and severe pericardial effusion. *Cardiovasc Revasc Med* 2017;18(5S1):S14-S17.
- Virk SA, Chandrakumar D, Villanueva C, Wolfenden H, Liou K, Cao C. Systematic review of percutaneous interventions for malignant pericardial effusion. *Heart* 2015;101:1619-1626.
- Ziskind AA, Pearce AC, Lemmon CC, Burstein S, Gimble LW, Herrmann HC, McKay R, Block PC, Waldman H, Palacios IF. Percutaneous balloon pericardiomy for the treatment of cardiac tamponade and large pericardial effusions: description of technique and report of the first 50 cases. *J Am Coll Cardiol* 1993;21:1-5.