

## Percutaneous Balloon Pericardiotomy in Patients with Recurrent Pericardial Effusion

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**Background.** Recurrent symptomatic pericardial effusion can complicate different cardiac and extracardiac diseases. When recurrent pericardial effusion after drainage with conventional catheter techniques occurred the creation of a pericardial window by open surgery used to be the unique treatment available until the recent development of percutaneous balloon pericardiotomy.

**Objective.** The aim of this paper is to review our initial experience with percutaneous balloon pericardiotomy for the treatment of patients with recurrent pericardial effusion.

**Patients and method.** Five patients with recurrent pericardial effusion have been treated with percutaneous pericardiotomy until now. Four patients had malignant pericardial effusion secondary to metastasis of extracardiac tumors, in one patient recurrent pericardial effusion was idiopathic. In all patients percutaneous balloon pericardiotomy was performed with a pediatric valvuloplasty balloon catheter, through a subxiphoid approach.

**Results.** Successful drainage and balloon pericardiotomy was achieved in all patients without severe complications. In all cases only one pericardial site was dilated. Minor complications were registered, which included mainly mild pleural effusion occurring in all patients with spontaneous resolution. During a mean follow-up period of  $8.6 \pm 6.5$  months (range 2 to 18 months) there were no recurrences of effusion or tamponade. Two patients died, 1 month and 9 months after the procedure, due to their malignant condition.

**Conclusions.** Percutaneous balloon pericardiotomy is an easy and useful technique to manage patients with large recurrent pericardial effusion with a low rate of complications.

**Key words:** *Pericardial effusion. Cardiac tamponade. Pericardiocentesis.*

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### Pericardiotomía percutánea con balón en pacientes con derrame pericárdico recurrente

**Introducción.** El derrame pericárdico recurrente puede complicar numerosas enfermedades de origen cardíaco y extracardíaco. Cuando tras una pericardiocentesis el derrame recurre, puede ser necesaria la realización de una ventana pericárdica quirúrgica, el único procedimiento disponible hasta el desarrollo de la pericardiotomía percutánea con balón.

**Objetivo.** El objetivo de este artículo es revisar nuestra experiencia inicial con la pericardiotomía percutánea con balón en pacientes con derrame pericárdico recurrente.

**Pacientes y método.** Hasta la fecha hemos tratado mediante esta técnica a 5 pacientes con derrame pericárdico recurrente. En 4 pacientes el derrame era secundario a metástasis pericárdicas de tumores extracardíacos y en un caso era idiopático. En todos los casos el procedimiento se realizó mediante abordaje subxifoideo y con balón de valvuloplastia pediátrica.

**Resultados.** En todos los casos se llevó a cabo la pericardiotomía con éxito con una sola intervención y sin complicaciones mayores. Se registraron pequeñas complicaciones consistentes fundamentalmente en derrame pleural leve o moderado, que ocurrió en todos los pacientes y que se resolvió de manera espontánea. Durante un período de seguimiento medio de  $8,6 \pm 6,5$  meses (rango, 2-18 meses) no se registró recurrencia del derrame pericárdico o nuevo taponamiento. Dos pacientes murieron tras 1 y 9 meses del procedimiento, respectivamente, debido a progresión de su enfermedad de base.

**Conclusiones.** La pericardiotomía percutánea con balón es un procedimiento sencillo, con una baja tasa de complicaciones y útil en el tratamiento de pacientes con derrame pericárdico severo recurrente.

**Palabras clave:** *Derrame pericárdico. Taponamiento cardíaco. Pericardiocentesis.*

### INTRODUCTION

Recurrent pericardial effusion is often caused by pericardial metastasis of extracardiac tumors. These effusions are generally copious hematic effusions that of-

ten lead to cardiac tamponade, which requires emergency drainage by pericardiocentesis. The recurrence rate of pericardial effusion after drainage is high, particularly in effusions of tumoral origin (13%-50%).<sup>1</sup> In patients with recurrent pericardial effusion, the treatment traditionally recommended includes, pericardiocentesis with instillation of sclerosing substances or chemotherapeutic agents,<sup>1,2</sup> opening a surgical pericardial window by a subxiphoid approach,<sup>3</sup> or pericardiectomy.<sup>4</sup> However, since patients generally have serious clinical conditions and impaired general status, it would be preferable to avoid the added risk of surgical intervention and general anesthesia. This motivated Palacios et al<sup>5</sup> to develop the percutaneous balloon pericardiectomy technique.

## PATIENTS AND METHOD

### Population

To date, we have performed percutaneous balloon pericardiectomy in 5 patients. The clinical characteristics of the patients are summarized in Table 1. In every case, pericardiectomy was performed in patients with severe pericardial effusion and clinical and echocardiographic signs of cardiac tamponade in which at least one recurrence had taken place after previous drainage. In 4 patients, the cause of the effusion was tumoral (Table 1), but in 1 patient with severe hematic effusion the results of cytology and a smear were negative.

### Procedure protocol

The procedure was carried out in the hemodynamics laboratory. After local anesthesia of the skin and subcutaneous cellular tissue, pericardial puncture was performed in the subxiphoid region under radiological control. A 0.035-inch vascular guide was inserted and the pericardial puncture needle was removed. A dilator was then passed and a drainage catheter was inserted over the guide. Samples were obtained for laboratory and histology studies. Part of the pericardial fluid was drained if necessary to stabilize the patient. Contrast was injected into the drainage catheter to highlight the

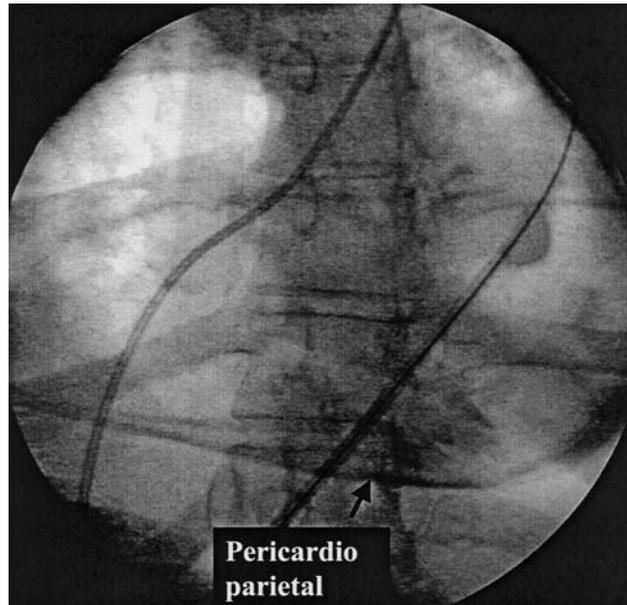


Fig. 1. Introducer in the pericardium through which contrast has been injected to locate the parietal pericardium.

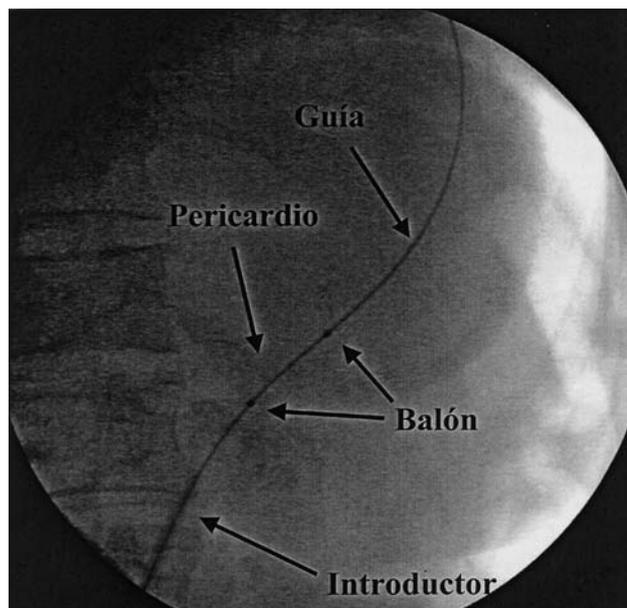


Fig. 2. Balloon inserted in the parietal pericardium through a 0.035-inch guide. Before inflating, the introducer is removed slightly.

TABLE 1. Percutaneous balloon pericardiectomy

	Age/sex	Disease	No. of pericardiocenteses before pericardiectomy	Postpericardiectomy pleural effusion	Recurrence	Follow-up
Patient 1	39/W	Lung cancer	2	Yes	No	9 months (death)
Patient 2	68/W	Lung cancer	1	Yes	No	1 month (death)
Patient 3	66/W	Breast cancer	2	Yes	No	20 months (alive)
Patient 4	77/M	Idiopathic	2	Yes	No	11 months (alive)
Patient 5	61/M	Lung cancer	2	Yes	No	4 months (alive)

W: woman; M: man.



**Fig. 3.** Progressive inflation of the balloon until the notch disappears, observing the typical hourglass image.

parietal pericardium (Figure 1). The drainage catheter was replaced by an introducer (9-11 Fr), then a pediatric valvuloplasty balloon (diameter 20 mm, length 30 mm) was advanced through a 0.038-inch vascular guide (Figure 2). The balloon was placed in the parietal pericardium under radiological control and was slowly inflated, confirming that the pericardium made a notch in the center of the balloon (hourglass image). Inflation pressure was then increased until the notch disappeared (Figure 3). The procedure was guided exclusively by fluoroscopy. Echography was performed at the end of the procedure to confirm the complete drainage of the pericardial effusion. After draining the pericardial fluid, a drain was left in place until the next day (as long as less than 100 ml was drained over the next 24 h). All patients received antibiotic prophylaxis with cloxacillin.

## RESULTS

In the 5 patients treated, the procedure was successful in a single session with one pericardial puncture. In 3 patients, a sufficient opening was obtained by inflating the balloon once. One patient required 3 inflations for correct balloon placement and pericardial opening. In one patient, the balloon could not be expanded completely with 4 inflations, but there was no later recurrence of pericardial effusion. The procedure took 80 min in the first case and 55-65 min in the following cases. In every case, the pericardial fluid was hematic and varied in volume from 700 to 1700 ml. Inflation of the balloon was accompanied in every patient by mild, transitory discomfort that disappeared immediately after deflating the balloon. Most patients had some degree of cardiac tamponade that immediately improved with drainage. Almost complete evacuation of the pericardial effusion was achieved in all patients. There were no post-procedure complications in any patient. Pleural effusion occurred in all the patients in the next 24-48 h, and resolved spontaneously in

all cases (Figure 4).

## FOLLOW-UP

During follow-up (4 to 20 months), 2 patients died from their malignancy. The time from pericardiectomy to death was 1 and 9 months, respectively. Pericardial effusion did not recur in any of the 5 patients treated and no patient has had cardiac tamponade. The 3 patients who remain alive, some of who have been followed-up for almost 2 years, have not been readmitted to the hospital for pericardial problems and show no signs of constrictive pericarditis.

## DISCUSSION

Pericardial effusion associated with pericardial metastasis of extracardiac tumors often leads to cardiac tamponade. Recurrence after pericardiocentesis is frequent.<sup>1</sup> The therapeutic options for the treatment of these patients, such as instillation of sclerosing substances or chemotherapeutic agents in the pericardium, are associated with high recurrence rates and patient discomfort.<sup>2,6</sup> Another option for these patients is surgery to create a pericardial window. Some of these techniques have the drawback of requiring general anesthesia, as in the case of thoracotomy to open a pleuropericardial window or pericardiectomy. This is an added risk in patients who are generally gravely ill. Using a subxiphoid approach to create a pericardial window has the advantage of requiring only local anesthesia, a low complication rate, and it allows the pericardium to be sampled.<sup>7</sup> For these reasons, it has been the preferred technique in recent years. Percutaneous balloon pericardiectomy is another therapeutic alternative in these patients. It can be viewed as a percutaneous variant of the subxiphoid approach to creating a surgical window, but it is even less traumatic. Our experience confirms that it is a simple procedure that can be

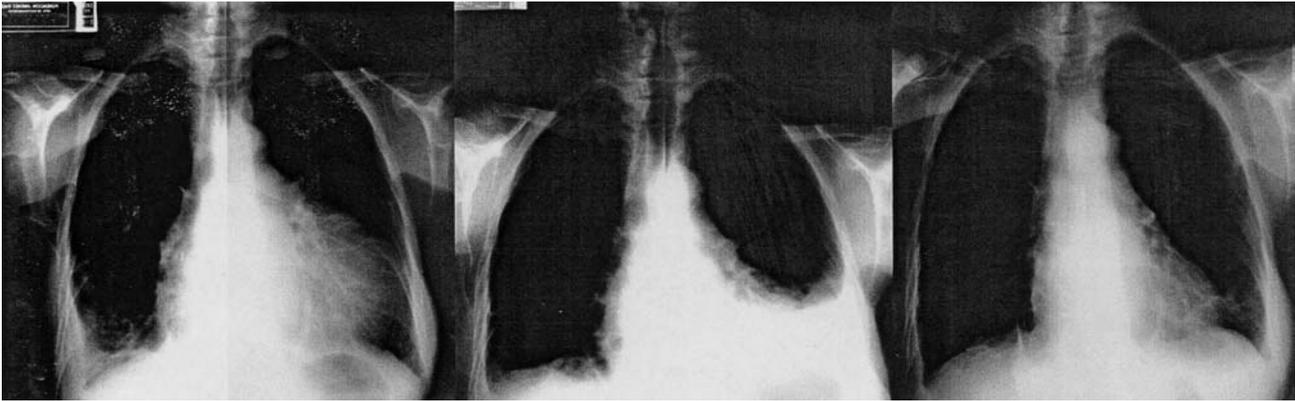


Fig. 4. Patient with post-pericardiotomy pleural effusion that resolved spontaneously in a week.

performed in seriously ill patients (cardiac tamponade) with a low rate of complications and little discomfort to the patient.

The mechanism of pericardial drainage is not entirely clear. All our patients had left pleural effusion after the procedure, so we assume that pericardial effusion does not accumulate because it drains into the pleural cavity. Drainage may also occur to the peritoneum or the parietal and visceral pericardium may fuse as a result of an inflammatory reaction to pericardiotomy.<sup>8</sup>

The complications of percutaneous pericardiotomy are similar to those of pericardiocentesis in general. Pericardial puncture is usually simple in these patients, with little risk of cardiac perforation due to the abundant pericardial effusion. Fever did not appear after the procedure in any of our patients, in contrast with other series,<sup>5</sup> probably because they were treated prophylactically with cloxacillin. Pleural effusion was the most frequent complication, with all our patients presenting it to some degree. The degree of pleural effusion is probably related with the quality of pleural drainage in these patients, which depends, in turn, on whether or not they have received thoracic radiotherapy or have tumoral pleural involvement and impaired lymphatic drainage. In some series, pleural drainage had to be performed to manage pleural effusion.<sup>5</sup> Pleural effusion resolved spontaneously in our patients.

Pericardiotomy may be performed as the initial therapy at the same time as the first pericardiocentesis. The advantages of this approach are that it eliminates the risk of a second pericardial effusion and eventual cardiac tamponade, which usually requires emergency pericardiocentesis. Up until now, we have always performed pericardiotomy as a separate procedure after at least one recurrence of pericardial effusion. The reason for this was that the diagnosis of tumoral pericardial

effusion had not been established at the time of pericardiocentesis in some patients. By deferring pericardiocentesis, we avoided pericardiotomy in 3 cases (all of tumoral origin) who had no recurrence of effusion after the initial pericardiocentesis. In addition, due to close echocardiographic follow-up of our patients after pericardiocentesis, pericardial effusion occurred, but not cardiac tamponade. This allowed pericardiotomy to be performed electively in a stable patient.

## CONCLUSIONS

We found percutaneous balloon pericardiotomy to be a simple and safe procedure. This procedure allows recurrent pericardial effusion to be treated with a high rate of success and scant complications. In addition, pericardial effusion did not recur within a relatively long time. The long-term prognosis of these patients depends mainly on their underlying disease.

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