Eleven Years' Experience with Pericardial–Peritoneal Window in the Management of Malignant and Benign Pericardial Effusions

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Background: Before 1983 we routinely used subxiphoid drainage for the management of pericardial effusions. Pericardial–pleural window through a left anterior thoracotomy was used in selected patients. Due to frustration over the rate of recurrent pericardial effusions with subxiphoid drainage alone and concern over the higher morbidity with thoracotomy, the creation of a 3-cm pericardial–peritoneal window in the fused portion of the pericardium and diaphragm overlying the left lobe of the liver was added to subxiphoid drainage in 1983.

Methods: This study is a retrospective chart review of the 33 patients undergoing pericardial–peritoneal window from 1983 through 1993. Eighteen patients had malignancies, mainly lung and breast, and 15 had benign pericardial effusions.

Results: The procedure was well tolerated, with a 30-day mortality of 9%; however, no deaths were directly related to the pericardial effusion or the procedure. No patient developed peritoneal carcinomatosis or diaphragmatic hernia. One patient developed recurrent pericardial effusion during follow-up, and two required pericardiectomy for constrictive disease. Among those with malignancies, patients with breast cancer had the longest survival after pericardial–peritoneal window.

Conclusions: Pericardial–peritoneal window is a simple, safe, and effective procedure and applicable to most patients with malignant and noninfectious benign pericardial effusion, including those with tamponade.

Key Words: Pericardial–peritoneal window—Pericardial effusion—Subxiphoid pericardial window.

Symptomatic pericardial effusion with acute cardiac tamponade is becoming a more frequent emergency in oncological and general medical practices. Lung, breast, and hematologic malignancies are the predominant causes of malignant effusions,

whereas most benign effusions are ideopathic. Universal agreement on the most efficacious method of management has been lacking. Recommended treatment varies from pericardiocentesis with or without injection of sclerosing agents, with or without subsequent systemic chemotherapy, to anterior thoracotomy with creation of a pericardial–pleural window or even subtotal pericardiectomy (1). Pericardiocentesis, although apparently safe and successful in some hands, has been reported to result in potentially serious side effects up to 15% of the time (2). Pericardial–pleural window and pericardiectomy, although effective, are major transthoracic procedures associated with significant morbidity

and mortality and usually must follow a preliminary pericardiocentesis.

Subxiphoid drainage of pericardial effusions, first described by Larrey in 1829 (3), reemerged in the 1970s and 1980s as a quick, simple, safe, and effective technique (4). It can be accomplished under local anesthesia, with almost no morbidity or mortality directly related to the procedure. Although short-term recurrences as low as 0–12% were reported (1,5), we were disappointed with a higher rate of failure. In 1983, we were faced with a young woman with a pericardial effusion and cardiac tamponade who was not a candidate for pericardial–pleural window because of previous bilateral pleurodeses. She had been treated with radiotherapy for a locally advanced esophageal cancer and was otherwise free of disease. Not wishing to rely on subxiphoid drainage alone, consent was obtained from the patient and her husband, a surgeon, to try a technique that, to our knowledge, had not yet been described or tried, although it has since been reported (6). This was to create by the subxiphoid approach a pericardial–peritoneal window in the fused portion of the pericardium and diaphragm overlying the left lobe of the liver. Theoretically this would allow continuous drainage of the effusion into the peritoneal cavity with the liver guarding against herniation and the motion of the diaphragm preventing closure of the window by adhesion formation. The operation, which took 45 min under general anesthesia, was uneventful and effective. Although the patient survived her disease for only an additional 2 months, an autopsy showed that the pericardial–peritoneal window remained patent and there was no recurrent effusion. Encouraged by the success of this and subsequent cases, the creation of a pericardial–peritoneal window became our standard procedure for the relief of malignant and noninfected benign pericardial effusions. Subdiaphragmatic drainage alone is used for infection, pericardiocentesis for most lymphomatous effusions, and left anterior thoracotomy with pericardial–pleural window for those patients who are not candidates for a pericardial–peritoneal window, such as patients on peritoneal dialysis. Extensive pericardiectomy is reserved for patients with constrictive disease.

MATERIALS AND METHODS

A retrospective chart review of all patients who underwent a surgical procedure for a pericardial ef-

fusion from 1983 and through 1993 was performed. Telephone contacts were made on those patients who were no longer followed at our institution. During the study period, two patients underwent subxiphoid window with tube drainage only for suspected infectious etiologies. In addition, left anterior thoracotomies with creation of pericardial–pleural windows were performed on five patients: two had uremic pericarditis and were on chronic peritoneal dialysis; one had coexisting interstitial lung disease, and lung biopsy was performed at the same time; and two had ideopathic effusions for unclear reasons. The remaining 33 patients, who underwent creation of a pericardial–peritoneal window through a subxiphoid approach, comprise the study group. These patients had symptomatic effusions or persistent large effusions requiring diagnosis and treatment. Nine patients had undergone prior pericardiocentesis and an additional patient had undergone an attempted, but unsuccessful, pericardiocentesis. All patients with malignancies were considered to have malignant effusions even if the cytology and histology were negative.

TECHNIQUE

Pericardial effusions are documented by physical examination, chest radiography, and echocardiogram. Many patients also undergo chest computerized tomography. Pericardiocentesis is not ordinarily performed but is undertaken in occasional unstable patients usually in the operating room just before the incision. The procedure is performed either under general or local anesthesia with conversion to general anesthesia after the pericardial sac is decompressed. The standard subxiphoid approach to the pericardium is used, frequently excising the xiphoid through an 8-cm upper midline incision. The pericardial sac is identified and the fluid is aspirated for cytology and cultures. A pericardiotomy is performed to completely decompress the pericardial sac and inspect the epicardium and visceral surface of the pericardium followed by the excision of a 5-cm oval segment of anterior–inferior pericardium. The peritoneum is then entered, and the pericardium that is fused to the anterior central tendon of the diaphragm over the left lobe of the liver is identified. This area is to the left of the coronary and falciform ligaments and anterior to the triangular ligament, all of which are left intact. A 3-cm circle of fused pericardium and diaphragm is excised and submitted to pathology along with the

previous specimen (Fig. 1). The edges of the created window are oversewn using a running suture of 2-0 Vicryl. A 10-mm flat silastic catheter is placed through the window into the pericardial sac, brought out through a separate stab wound, and attached to closed bulb drainage. The midline wound is closed in the standard fashion. The catheter is removed when the drainage is minimal, usually on postoperative day 1 or 2.

RESULTS

Eighteen of the 33 patients had malignancies, although no tumor was identified in the pericardium or pericardial fluid in eight. The benign group consisted of uremic effusions (n = 3), connective tissue diseases (n = 3), and ideopathic effusions (n = 9). Thirteen patients had evidence of tamponade at the time of surgery, including two patients with recurrent tamponade after pericardiocentesis. The other characteristics of the two groups are listed in Table 1. In general the operation was well tolerated, with only one patient developing significant intraoperative hypotension without sequela. The operative time was longer in obese patients. Chest tubes were placed for later pleurodesis in three patients with coexisting malignant pleural effusions. Six patients experienced a total of eight complications: lobar pneumonia (n = 2), atrial fibrillation (n = 2), fascial dehiscence (n = 1), urinary tract infection (n = 1), intraoperative entry into left pleural space (n = 1), and fibrinous constrictive pericarditis (n = 1). The last complication occurred in a patient with rheumatoid arthritis and unsuspected *Staphococcus aureus* septicemia with an infected pericardial effusion. He did well after bilateral anterior thoracotomy with pericardiectomy. No patient died as a direct result of pericardial effusion or the operative procedure. However, three patients with extensive locoregional non–small cell lung cancer and large pericardial effusions died secondary to respiratory failure at 2, 7, and 15 days postoperatively despite relief of cardiac compression. A fourth patient with esophageal cancer and radiation pneumonitis died at 52 days without leaving the hospital. The hospital stay ranged from 3 to 7 days for patients undergoing creation of a pericardial–peritoneal window only. Many patients had longer hospital stays due to receiving additional treatment, including chemotherapy, chemical pleurodeses, or treatment of coexisting cardiac disease.

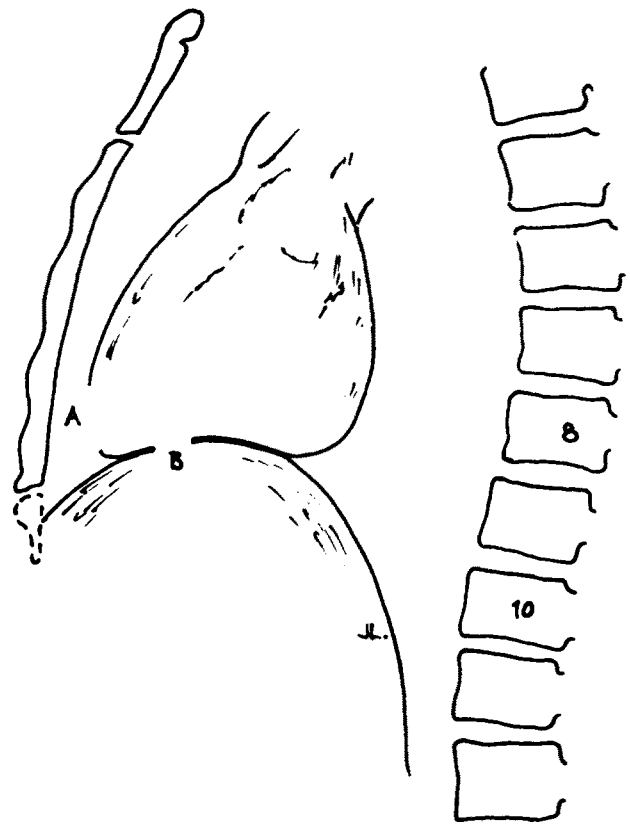Autopsies on six patients with malignant effu-

FIG. 1. Position of pericardial–peritoneal window. A: Initial pericardiectomy in anterior inferior pericardium. B: Pericardial–peritoneal window in fused portion of inferior pericardium and central tendon of diaphram overlying left lobe of liver.

sions who died from 7 days to 22 months postoperatively showed minimal if any effusion, some pericardial adhesions, and patent windows in all six. However, one patient developed a recurrent pericardial effusion. This patient with rheumatoid arthritis and silicosis at 13 months postoperatively developed a late recurrent effusion with tamponade. He underwent successful decompression by pericardial–pleural window through a left anterior thoracotomy. This patient appeared to have developed adhesions between the inferior surface of the heart and the pericardium, blocking the window. Another patient with breast cancer developed constrictive pericarditis secondary to markedly thickened pericardium with a small loculated effusion 7 months postoperatively. She survived an additional year after median sternotomy and subtotal pericardiectomy. There were no other late complications, including diaphragmatic hernia, peritoneal carcinomatosis, or other sequelae of the operative technique.

Of the patients with malignancy, 83% survived

TABLE 1. Patient characteristics

	All PPW	Benign	Malignant
n	33	15	18
Sex (F:M)	18:15	7:8	11:7
Age (yr)[a]	61 (39–85)	61 (39–85)	59 (41–72)
Effusion size (ml)[a]	500 (50–1,600)	500 (50–1,600)	525 (50–1,200)
Tamponade	13 (39%)	8 (53%)	5 (28%)
Operative time (min)[a]	78 (25–143)	85 (25–140)	75 (45–143)
Hospital stay (days)[a]	9 (3–47)	7 (3–36)	9 (4–47)
Complications	6 (18%)	4 (27%)	2 (11%)
30-day mortality	3 (9%)	0	3 (17%)
Follow-up time (mo)[a]	4 (<1–96)	18 (<1–96)	2 (<1–31)
Recurrent effusion	1 (3%)	1 (7%)	0
Constrictive pericarditis	2 (6%)	1 (7%)	1 (5%)

ppw, pericardial–peritoneal window.
[a] Median (range).

>1 month and 44% >3 months. Only one patient remains alive at 25 months postoperatively. She is clinically free of disease on tamoxifen for her breast cancer. All deaths were due the underlying malignancy. Survival by type of cancer is shown in Table 2.

DISCUSSION

The creation of a pericardial–peritoneal window as a modification of the subxiphoid window drainage procedure for the relief of symptomatic pericardial effusion has proven effective in our experience, with only one significant recurrent effusion in 33 patients treated over the past 11 years. Like the standard subxiphoid approach, which consists of a drainage tube placed through a "window" formed by excision of a segment of anterior inferior pericardium and brought out directly through the subcutaneous tissue and skin, the pericardial–peritoneal window is well tolerated in these typically debilitated patients. The operation can be safely and easily accomplished in less than an hour

by an experienced surgical team. It is performed under local or general anesthesia, with minimal related morbidity compared with that for transthoracic pericardial–pleural window or pericardiectomy. It allows decompression of the pericardium under direct vision, thereby avoiding the potential risks of pericardiocentesis. Upward sternal retraction in all but the obese or very large patient allows ample exposure for exploration and a generous partial pericardiectomy if needed for diagnostic or therapeutic purposes. In our series the potential sequelae of diaphragmatic hernia and peritoneal carcinomatosis have not occurred nor have they been reported in the literature.

Universal agreement is lacking concerning the mechanism of a successful pericardial window. Prager et al. (7) reported that recurrent pericardial effusion is not a problem when using the standard subxiphoid approach, providing that at least a 4 × 4 cm segment of pericardium is excised to allow absorption of the pericardial fluid by the subcutaneous tissue after the drain is removed. On the other hand, the University of Chicago group believes that the

TABLE 2. Outcome in patients with malignant effusions by primary cancer

Primary site	No. of patients	Dead of disease (mo)					Alive NED
		<1	1–3	3–12	12–24	>24	
Breast	4				2	1	1 (25 mo)
Lung							
Non–small cell	8	3	2	3			
Small cell	2		1		1		
Esophagus	2		2				
Renal cell	1		1				
All[a]	17	3	6	3	3	1	1

NED, no evidence of disease.
[a] One patient with lymphoma/acquired immunodeficiency syndrome lost to follow-up at 14 days.

mechanism of action is an inflammatory response to the procedure, resulting in obliteration of the pericardial space (8). To accomplish this, water seal drainage is maintained on suction, usually for 3–5 days. Recurrent tamponade occurred in two of their 28 patients. Alcan reported good results, with only one recurrent effusion in 18 patients with subxiphoid drainage alone when tube decompression was performed for an average of 9.6 days (range 3–28) (9).

Autopsies on six of our patients with malignant effusions did not show fusion of the pericardium to the epicardium, but rather patent windows and only minimal adhesions. Therefore, we feel that the patent pericardial–peritoneal window remains functionally active in preventing the recurrence of pericardial effusions. The creation of the pericardial–peritoneal window allows the drain to be removed in 1–2 days as in our patients or not used at all as reported by Dabir and Warren (6), allowing for shorter hospital stays. Recently, reports of laparoscopic pericardial–peritoneal window (10) and thoracoscopic pericardial–pleural window (11) have advocated minimally invasive surgery as a method of reducing the morbidity of treatment of pericardial effusions. However, the pneumoperitoneum in the former and double-lumen endotracheal intubation with lung collapse in the latter may complicate anesthesia care, making the procedure more risky. Because of its efficiency, safety, and success, the pericardial–peritoneal window technique would clearly appear to be the treatment of choice for the relief of most symptomatic malignant and noninfectious benign pericardial effusions. Although some patients with extensive malignancy may not benefit from the operation, others, especially those with breast cancer, can be expected to have prolonged survival after this procedure.

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