Surg Endosc (1997) 11: 253–256

Surgical Endoscopy

Thoracoscopic partial pericardiectomy in the diagnosis and management of pericardial effusion

R. Robles,[1] A. Piñero,[1] J. A. Luján,[1] J. A. Fernández,[1] J. A. Torralba,[1] F. Acosta,[2] M. Villegas,[3] P. Parrilla[1]

[1] Servicio de Cirugía general y del A. Digestivo, ''Virgen de la Arrixaca'' University Hospital, 30120, El Palmar, Murcia, Spain
[2] Servicio de Anestesiología y Reanimación, ''Virgen de la Arrixaca'' University Hospital, 30120, El Palmar, Murcia, Spain
[3] Servicio de Cardiología, ''Virgen de la Arrixaca'' University Hospital, 30120, El Palmar, Murcia, Spain

Received: 30 May 1996/Accepted: 27 August 1996

Abstract
Background: An effort was made to present our experience with thoracoscopy in the diagnosis and management of pericardial effusions.
Methods: Twenty-two partial pericardiectomies were performed with the thoracoscopic approach in patients with pericardial effusions, the etiology of which was uremic ($n = 7$), neoplastic ($n = 8$), idiopathic ($n = 5$), septicemia ($n = 1$), and postpericardiotomy ($n = 1$). All cases had grade III-IV/IV radiological cardiomegaly and ultrasonographic confirmation of the effusion. We found hemodynamic compromise in 17 patients. The operation, requiring the insertion of three trocars, enabled us to remove a large part (approximately 6 × 10 cm) of the left anterolateral side of the pericardium and aspirate the effusion contents for diagnostic and therapeutic purposes.
Results: In five cases we found coexisting pleural effusions. The pericardial effusion had a mean volume of 817 ml, which was serous in 11 cases, hematic in six, serohematic in four, and purulent in one. Cytology of the pericardial effusion was positive for neoplasia in four cases (one pulmonary neoplasia, two breast carcinomas, and one lymphoma). We observed conversion to grade I/IV cardiomegaly in 16 cases and a return to normality in the other six, with the absence of ultrasonographic effusion in all cases. There was no recurrence during the mean follow-up period of 20.5 months (range: 2–47).
Conclusions: The thoracoscopic management of pericardial effusions is a simple and effective technique that allows us to create a large pericardial window that drains the effusion definitively, determines its etiology, and explores and treats coexisting pleural lesions, all without recurrences.

Key words: Pericardial effusions — Pericardial window — Partial pericardiectomy — Thoracoscopy — Video-assisted thoracoscopic surgery

Correspondence to: R. Robles Campos

The creation of a pericardial window has been used to manage pericardial effusions by means of different approaches: subxiphoid [12], sternotomy [15], or left anterior thoracotomy [10, 11, 15].

Endoscopic surgery has witnessed a major development in the last 5 years and has been applied to numerous techniques performed via thoracic [4] or abdominal approach [18]. One such technique creates a pericardial window or thoracoscopic partial pericardiectomy to manage pericardial effusions that resist medical treatment or cause a hemodynamic compromise [13, 20].

The aim of this paper is to present the results obtained in a series of 22 patients managed with this technique, analyzing whether these results are an improvement on those reported in the literature with other approaches (subxiphoid, sternotomy, or left anterior thoracotomy).

Patients and surgical technique

Between April 1992 and December 1995 we drained 22 pericardial effusions using partial pericardiectomy via the thoracoscopy approach (Table 1). Mean patient age was 52.4 years (range 18–81). Thirteen patients were women and nine were men. The patients presented with pericardial effusions that were resistant to medical treatment (five patients) or had an important haemodynamic compromise (17 patients). Preoperative chest radiology revealed grade III-IV/IV cardiomegaly in all cases. Preoperative ultrasound demonstrated massive pericardial effusion with a mean ejection fraction of 57.3% (range 20–60%) and collapsed right cavities in 17 patients. The pathology responsible for the pericardial effusion was as follows: in seven cases uremic effusion, due to chronic renal insufficiency; in eight cases neoplasia (four due to breast cancer, two to lung cancer, one to epidermoid carcinoma of the esophagus, and one to a nonHodgkin's lymphoma); idiopathic in five cases; sepsis in a patient with mediastinitis and pleural empyema;

Table 1. Characteristics of the series[a]

No.	Sex	Age (years)	Etiology	Volume (ml)	Type	E. F. (%)	S. T. (min)	H. S. (days)	Follow-up (months)	Exitus
1	F	18	Uremic	600	Serous	35	50	4	25	No
2	M	58	Lung cancer	700	Serous	50	50	9	35	Yes
3	F	36	Uremic	700	Serous	50	45	12	40	No
4	F	29	Uremic	800	Serohem.	55	50	8	24	No
5	M	61	Uremic	600	Serous	60	45	3	47	No
6	F	76	Idiopathic	500	Serous	60	45	8	25	No
7	F	39	Breast cancer	400	Hemorr.	60	40	3	26	No
8	M	41	Uremic	500	Serous	55	35	4	24	No
9	M	55	Postperic	1,100	Hemorr.	50	60	5	23	Yes
10	M	67	Idiopathic	600	Serous	55	45	10	21	No
11	F	60	Lung cancer	800	Hemorr.	40	45	8	20	Yes
12	F	30	Uremic	600	Hemorr.	60	60	10	18	No
13	M	35	Sepsis	500	Seropur.	60	45	15	18	Yes
14	M	53	Lymphoma	1,300	Hemorr.	60	30	10	25	Yes
15	F	64	Uremic	1,500	Serous	60	35	6	16	No
16	F	59	Breast cancer	500	Serous	60	30	3	14	No
17	F	68	Idiopathic	250	Serohem.	60	40	2	12	No
18	M	46	Esoph. cancer	1,525	Serohem.	20	40	2	12	No
19	F	62	Breast cancer	1,400	Serous	45	25	5	12	No
20	F	46	Breast cancer	1,700	Hemorr.	60	45	2	10	No
21	F	81	Idiopathic	1,100	Serohem.	60	35	2	2	No
22	M	69	Idiopathic	400	Hemorr.	60	30	2	2	No

[a] M: male; F: female; E. F.: ejection fraction; Hemorr.: hemorragic; Serohem.: serohematic; Seropur.: seropurulent; S. T.: surgical time; H. S.: hospital stay; Postperic.: postpericardiotomy; Esoph. cancer: Esophagus cancer

and one case of postpericardiotomy effusion due to previous valvular surgery.

Surgery was done under general anesthesia and orotracheal intubation. The patient was placed in the decubitus position on his/her right side so that the thoracoscopic approach could be made via the left hemithorax. The surgeon and assistant stood at the patient's back with the video monitor opposite on the other side of the patient. Three trocars were inserted: one 10-mm trocar in the fifth left intercostal space (IS) along the posterior axillary line, for the straight telescope, and two 5-mm trocars in the fourth and seventh left IS along the anterior axillary line, for the forceps, hook, scissors, and aspiration. If pulmonary distention hampered vision, this could be avoided by increasing the respiratory frequency and decreasing the inspiratory volume of the ventilator. If this were not sufficient, we could generate a pneumothorax with CO_2 at a positive pressure of 6 mmHg through one of the 5-mm trocars. After the identification of the phrenic nerve an orifice was created through which most of the pericardial effusion was drained; after this, a large pericardial window of some 6 × 10 cm was opened. In all cases we left an aspirative pleural drainage for 48 h.

The following determinations were made of the fluid obtained: cell count and cytology, culture and stains (Gram, Ziehl, and Papanicolau), biochemical analysis (Na^+, K^+, Cl^-, Glu, BUN), detection of nonorganospecific antibodies (ANOEs), and in the last three patients, Adenosine Deaminase (ADA) analysis. The extirpated pericardium was divided into two fragments: one for culture and the other for anatomopathological study.

The results were assessed by chest X-ray and ultrasound, which were performed in the immediate postoperative period and periodically during the follow-up. Mean follow-up was 20.5 months (range 2–47).

Results

Operative findings

Exploration of the pleural space enabled us to find loculations and easily removable adhesions in two patients, pleural effusions in five patients, and pleural metastasis in two patients. The mean volume of the pericardial effusion aspirated was 817 ml (range: 250–1,700). It was serous in 12 patients, hematic in six, serohematic in three, and seropurulent in the mediastinitis patient. Mean surgery time was 42 min (range: 25–60).

Diagnostic efficiency

The cultures of the pericardial effusion, pleural fluid and hemocultures in the mediastinitis patient were positive for *Streptococcus* sp. The remaining cultures of pleural and pericardial fluid were negative. Cytology of the pericardial effusion was positive for neoplastic cells in four patients (two breast carcinomas, one lung carcinoma, and one patient with lymphoma), and neoplastic involvement of the pericardium was confirmed in the histological study in two of them. The cytological study in an effusion initially considered idiopathic demonstrated a cellularity compatible with adenocarcinoma (lung cancer). Pleural cytology was negative in the five cases in which associated pleural effusion was found. The histological study of the pericardium, except in the two above-mentioned patients, demonstrated a fibrosis with nonspecific chronic inflammation and mesothelial hyperplasia. Two patients have histological demonstration of pleural metastasis.

Morbidity and mortality

Only one patient had immediate postoperative complications with the development of a pleural effusion, which

required thoracocentesis. There was no intraoperative mortality. Two patients died in the immediate postoperative period: one on day 5 for bilateral pneumonitis due to cytomegalovirus (patient suffering from familial Mediterranean fever) and one on day 15 following sepsis (mediastinitis patient). Hospital stay averaged 6 days (range: 2–15).

Follow-up

In the immediate postoperative period there was radiological conversion to grade I cardiomegaly in 16 patients and a return to normality in the remaining six. In the 20 surviving patients, periodical follow-up with ultrasound assessment showed the absence of recurring effusion. Three patients were lost to the long-term follow-up, all due to the development of an underlying neoplastic disease (at 3 months in a patient with lung cancer, at 10 months in the lymphoma patient, and at 1 year in another lung cancer patient).

Discussion

The therapeutic options in the management and treatment of patients with pericardial effusions are very varied [3, 14]: corticoids, external beam irradiation, pericardiocentesis alone or with instillation of chemotherapeutic agents, and surgery. There are three fundamental surgical possibilities: complete pericardiectomy, pericardial window (both performed via the thoracotomic or thoracoscopic approach), and subxiphoid pericardiotomy. Any of these techniques must fulfill the three fundamental objective of any therapy for effusion: resolve it, determine its aetiology, and avoid recurrences, all with the least possible morbidity and mortality [4].

Resolution of the effusion is quick with any of the three techniques. Subxiphoid pericardiectomy requires a mean operating time of some 30–45 min [3], similar to that recorded in our thoracoscopic experience. Thoracotomy requires more time than the other two methods.

The diagnostic capacity of any of these techniques will depend on the possibility of thoroughly exploring the pericardial cavity and pleural space and on the possibility of obtaining sufficient study material (biopsies and effusion samples). Thoracoscopy has a better diagnostic capacity in these aspects than the other techniques [6], as it enables us to explore the pleural cavity thoroughly and visualize and obtain samples of suspicious lesions and associated effusions (effusions were found in five of our patients and tumoral implants in two). Furthermore, it provides a wide view of the pericardial surface, which gives the most suitable place for biopsies, and the pericardial cavity can be explored easily for septa, localized effusions, or tumoral implants. This diagnostic capacity is important from a therapeutic and prognostic point of view, since many of the patients are neoplastic, but their effusions are not. In our series, of eight neoplastic cases only four had positive cytology for the primary neoplasm, and in one of them it diagnosed the underlying condition (lung cancer). The thoracotomic approach also evaluates the pleural cavity and pericardial surface [10], but less so than thoracoscopy [7]. The subxiphoid approach is limited in its exploratory capacity, because it enables samples of the pericardium and fluid to be obtained, it is not guided and moreover does not enable the whole of the pericardial surface or pleural space to be visualized.

After a follow-up period of 20.5 months we had no recurrence. These data contrast with those reported for the subxiphoid procedures with recurrence rates ranging from 2.5% to 18% (reoperation rates ranging from 0% to 9%) [1, 2, 9, 15, 19, 20]. Thoracotomy presents very low rates of recurrence. According to some authors [4, 15, 19] the recurrence rate is related to the diameter of the window created, which means that the greater the pericardial exposure and resection the lower the rate of recurrences, even if the efficiency mechanism of this procedure is highly debated.

Morbidity and mortality with the thoracoscopic approach are minimal; only one of our patients had a pleural effusion requiring thoracentesis. There was no intraoperative or postoperative death related to the technique. Respiratory complications did not exist, and postoperative pain was minimal. The thoracotomic approaches have a greater morbidity rate [9, 14], mainly as a result of respiratory complications. The subxiphoid approach had fewer complications than thoracotomy, although more than thoracoscopy, with morbidity figures of 5 to 20% [3, 9, 14, 17].

One of the main inconveniences attributed to thoracoscopy is that it requires general anesthesia, whereas the subxiphoid approach can be performed with local anesthesia [11], this being one of the main reasons for its more widespread use. However, for greater patient comfort and improvement management in a more stable surgical field, many authors carry out this procedure with general anesthesia and endotracheal intubation [5, 8, 13, 16].

The type of intubation—selective or endotracheal—is another controversial point. Selective intubation with ventilation of a lung facilitates visualization of the pericardium and reveals possible hemodynamic effects. Even then, since the beginning of our experience and as has been the case for other authors [8], all the procedures have been carried out with general anesthesia and endotracheal intubation. To improve visualization we decrease pulmonary distension by lowering the inspiratory volume and raising the respiratory frequency. When visualization is not correct we perform a low-pressure pneumothorax (6 mmHg) and have had no problem with this technique. Conversely, in the only patient with selective intubation the degree of hypoxemia required a conversion to endotracheal intubation; furthermore, it was noted that contralateral hyperinsufflation and the consequent mediastinal shift made surgical management of the effusion very difficult.

In conclusion, we recommend the thoracoscopic approach in the management of pericardial effusions, rather than the subxiphoid or thoracotomic approaches, because of its good diagnostic and therapeutic capacity, the low morbidity and mortality rates, and the absence of long-term recurrences.

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