Türk Göğüs Kalp Damar Cerrahisi Dergisi 2012;20(3):492-496
doi: 10.5606/tgkdc.dergisi.2012.095

Management of pericardial effusion by subxiphoidal pericardiostomy in adults

Erişkinlerde subksifoidal perikardiyostomi yöntemi ile perikardiyal efüzyon tedavisi

Volkan Yüksel,[1] Serhat Hüseyin,[1] Ahmet Okyay,[1] Selami Cem Gürkan,[2] Özcan Gür,[2] Suat Canbaz,[1] Enver Duran[1]

[1]Department of Cardiovascular Surgery, Medical Faculty of Trakya University, Edirne, Turkey;
[2]Department of Cardiovascular Surgery, Medical Faculty of Namık Kemal University, Tekirdağ, Turkey

Background: We aimed to assess the effectiveness of subxiphoid pericardiostomies in the treatment of patients with pericardial effusion (PE) and to discuss the etiology for this patient population.

Methods: Between January 2004 and January 2011, 148 patients (77 males, 71 females; mean age 60.1±12.3 years; range 34 to 89 years;) who underwent a subxiphoid pericardiostomy and tube drainage due to a diagnosis of PE were retrospectively analyzed.

Results: Echocardiography classified PE as severe in 36 patients, moderate in 68, and mild in 44. The main causes of PE were uremia and malignancy along with idiopathic and undefined tuberculous and non-tuberculous pericarditis. A perioperative myocardial injury requiring a sternotomy occurred in two patients. A histopathological examination contributed to the diagnosis in 84.3% of the patients with malignancy. The overall 30-day mortality rate was 7% (n=11). Pericardial constriction requiring a pericardiectomy developed in two patients.

Conclusion: Pericardial effusion can be an effective and quick method for managing adults with subxiphoid pericardiostomy.

Key words: Etiology; pericardial effusion; pericardial tube drainage; subxiphoidal pericardiostomy.

Amaç: Bu çalışmada perikardiyal efüzyon (PE)'lu hastaların tedavisinde subksifoidal perikardiyostomi tekniğinin etkinliği değerlendirildi ve bu hasta nüfusundaki etyolojik nedenler irdelendi.

Çalışma planı: Ocak 2004 - Ocak 2011 tarihleri arasında PE tanısı konulan ve subksifoidal perikardiyostomi uygulanan 148 erişkin hasta (77 erkek, 71 kadın; ort. yaş 60.1±12.3 yıl; dağılım 34-89 yıl) retrospektif olarak incelendi.

Bulgular: Ekokardiyografide 36 hasta ciddi, 68'i orta ve 44'ü hafif derecede PE olarak sınıflandırıldı. Perikardiyal efüzyon etyolojisinde ana nedenler olarak üremi, malignansi, idiyopatik, tüberküloza bağlı veya bağlı olmayan perikardit saptandı. Ameliyat sırası miyokard hasarı sonrası sternotomi iki hastada gerekli oldu. Histopatolojik değerlendirme malignansi hastalarının %84.3'ünde tanıya yardımcı oldu. Otuz günlük genel takiplerde mortalite %7 (n=11) idi. Perikardiyektomi gerektirecek perikardiyal konstriksiyon iki hastada gelişti.

Sonuç: Erişkinlerde PE tedavisinde subksifoidal perikardiyostomi etkili ve hızlı uygulanabilecek bir yöntemdir.

Anahtar sözcükler: Etyoloji; perikardiyal efüzyon; perikard tüp drenajı; subksifoidal perikardiyostomi.

Pericardial effusion (PE) is a life-threatening condition in which an accumulation of fluid in the pericardial sac can lead to cardiac tamponade.[1] It is often associated with an underlying disease or condition, and the causes can vary widely.[2-4] Pericardiocentesis performed by needle with echo guidance and various surgical procedures, for example subxiphoid pericardial tube drainage, a pericardial window done through a left anterior thoracotomy, or video-assisted thoracoscopic surgery, can alleviate PE.[5-7] Our retrospective

Available online at
www.tgkdc.dergisi.org
doi: 10.5606/tgkdc.dergisi.2012.095
QR (Quick Response) Code

Received: July 2, 2011 *Accepted:* November 13, 2011

Correspondence: Volkan Yüksel, M.D. Trakya Üniversitesi Tıp Fakültesi, Kalp ve Damar Cerrahisi Anabilim Dalı, 22030 Edirne, Turkey.
Tel: +90 284 - 235 06 65 e-mail: drvyuksel@yahoo.com

clinical experiences of treating PE with a subxiphoid pericardiostomy are presented in this study.

PATIENTS AND METHODS

We reviewed the medical records of 148 patients (77 males, 71 females; mean 60.1±12.3 years; range 34 to 89 years) who underwent a subxiphoid pericardiostomy to treat symptomatic PE in our clinic between January 2004 and January 2011. Echocardiography (ECG) was used to diagnose PE and determine the size of the effusion. A diastolic echo-free space of less than 10 mm between the left ventricular posterior wall and pericardium was classified as mild PE, a space of 10-20 mm as moderate, and a space of more than 20 mm as severe. Patients with cardiac tamponade and/or moderate to severe PE were treated by a subxiphoid pericardiostomy and tube drainage.

Patients with tuberculosis were treated with anti-tuberculosis therapy preoperatively, and the effusion was drained after a three-week course of this therapy. In those patients diagnosed with tuberculous pericarditis, the tuberculosis therapy regimen was given for 12 months postoperatively.

The surgical procedure was performed by either general anesthesia or local anesthesia plus adequate sedation. A small incision was made from the lower end of the sternum caudally for approximately 6-8 cm. The upper linea alba was divided in the midline and the xiphoid sternum was split or resected. The anterior pericardium was incised, and the fluid was drained and sent for bacteriological and cytological analyses. A piece of anterior pericardium approximately 2-4 cm in diameter was then excised under direct vision and submitted for histopathological analysis. The pericardial cavity was decompressed, and fluid samples were collected for culture and cytological analysis. In order to prevent acute cardiac dilatation during decompression of the pericardial cavity, the pericardial cavity was decompressed gradually. This cavity was examined under direct vision and/or by digital examination to detect any tumors or adhesions. Gentle digital lysis of adhesions and opening of loculations were performed as needed to enhance satisfactory drainage. A soft chest tube (28F or 32F) was placed in the pericardial cavity through a separate incision, inferior to the right ventricle, after a pericardiotomy for postoperative drainage. It was connected to an underwater sealed system and was removed when fluid drainage ceased. The abdominal incision was closed with interrupted or running absorbable sutures. The chest tube was left in place for four to five days after the operation. Patients were followed up with physical examinations and ECG in the outpatient clinic for at least six months.

Numerical results are given as mean ± standard deviation (SD). Fisher's exact test was used to compare proportions between groups (comparison of the rates of recurrence and constriction between patient groups with uremic pericarditis, tuberculous pericarditis, and non-tuberculous bacterial pericarditis). Statistical differences were considered significant if $p<0.05$.

RESULTS

Mild effusion was diagnosed in 44 patients (30%), moderate effusion in 68 patients (46%), and severe effusion in 36 patients (24%).

The symptoms and signs in all patients with cardiac tamponade were unspecific, but 104 had increased systemic venous pressures, pulsus paradoxus, and tachycardia despite having normal blood pressure, whereas 36 patients had additional hypotension due to the tamponade.

The operations were performed using local anesthesia, which was preferable, and adequate sedation in 119 patients (80.4%) and under general anesthesia in 29 patients (19.6%). All patients with symptomatic PE obtained immediate subjective relief from the pericardiostomy as the pulse rate and blood pressure became normalized, and jugular venous distension simultaneously subsided. Myocardial injury, attributable to the operation, occurred in two patients (1%) and could not be controlled by the subxiphoid approach. An immediate median sternotomy was therefore required for these patients. Myocardial injury occurred during the first pericardial excision because of severe pericardial adhesions with tuberculous pericarditis in one patient and mesothelioma in the other.

The etiological causes of PE in this study were malignant processes invading the pericardium, uremic pericarditis, idiopathic and undefined pericarditis, tuberculous pericarditis, and non-tuberculous bacterial pericarditis (Table 1).

A histopathological examination of the pericardial specimen and fluid (or both) was positive for malignant cells in 27 (84.3%) of the 32 patients with PE due to malignant processes invading the pericardium. An examination of the pericardial fluid alone failed to diagnose the cause of PE in five patients as malignant processes invading the pericardium, but the histopathological examination of the pericardial specimen revealed the diagnosis in all of them. Of the 32 malignant patients, 18 had lung cancer, six had breast cancer, four had lymphoma,

Table 1. Etiological causes of pericardial effusion and the results of a subxiphoid pericardiostomy in 148 patients

	Number of patients (% of total)		Constriction	Mortality (30 day)
	n	%	n	n
Uremic pericarditis	97	65.5		3
Malignancy	32	21.6		6
Idiopathic pericarditis	16	10.8	1	2
Tuberculous pericarditis	2	1.4	1	
Non-tuberculous bacterial pericarditis	1	0.7		
Total	148		2	11

one had a malignant mesenchymal tumor, one had mesothelioma, one had multiple myeloma, and one had gastrointestinal cancer.

The microorganisms identified in cultures of the pericardial fluid taken from the patients with infectious pericarditis were: *Mycobacterium tuberculosis* (n=2) and *Streptococcus sanguis* (n=1). A cytological examination of the fluid and pericardial specimens obtained during surgery identified the etiology of PE in both of the patients with tuberculous pericarditis.

Drainage volume during the operation ranged between 300-2000 ml (mean 972±297 ml). The highest drainage volume was obtained from a patient with uremia and the lowest from a patient with lung cancer. Patients were followed up by routine ECG, and no recurrence developed during the early postoperative period.

The patients were hospitalized for between seven and 21 days (mean 10.8±6.2 days), and the overall 30-day mortality rate was 7% (n=11). Low cardiac output was the cause of death in patients who died in the postoperative period, and this occurred despite inotropic support and resuscitative measures. At the six-month follow-up, 19 patients with malignancy had died due to several causes related to the primary disease.

All surviving patients were followed up for at least six months. Constrictive pericarditis, which required a pericardiectomy (by median sternotomy), developed in two of the 118 surviving patients. One of these patients was originally diagnosed with tuberculous bacterial pericarditis and one with idiopathic pericarditis.

DISCUSSION

Pericardial effusion is often related to an underlying condition such as uremia, malignancy (lung, breast, and ovarian carcinoma, leukemia, and lymphoma), infection (frequently viral), autoimmune disorders, myocardial infarction, and iatrogenic causes.[2,3,8] In our study group, uremia was the most frequent cause of PE although some reports have stated that uremic pericarditis is a less frequent cause of pericarditis.[3,9]

The presentation of PE can range from minimally symptomatic to a state of complete cardiovascular decompensation. Pericardial disease is a common entity, but pericardial tamponade is considered to be an unusual presenting feature. Previous studies have reported tamponade in 44% of patients,[9] but it occurred in only 24% (n=36) of our patients.

The optimal treatment for benign and malignant PE in patients who develop tamponade remains controversial. Ideal effusion management should ensure complete and permanent drainage and provide sufficient histological, cytological, and microbiological material for diagnostic study. It should also be performed with minimal discomfort and risk to the patient. Various effective drainage techniques are available, but no one technique is optimal for all patients and circumstances.[6,9-12] A subxiphoid pericardiostomy can be performed under local anesthesia. This allows for direct visualization, biopsy, and exploration of the pericardium and pericardial cavity.

A variety of procedures are used in the treatment of PE ranging from needle pericardiocentesis to open surgical drainage. The choice depends mainly on the etiology of the PE. Purulent pericarditis should be drained surgically, usually through a subxiphoid pericardiotomy.[12] The management of cardiac tamponade in patients with malignancy should focus on relief of the tamponade and prevention of reaccumulation. Simple pericardiocentesis relieves symptoms, but PE relapses in nearly half of the patients. Indwelling pericardial catheters have a high success rate of up to 75%, but catheter infection remains a potential complication. Surgical drainage procedures can be performed for the relief of pericardial effusion. Complete pericardiectomies, partial pericardiectomies, and subxiphoid pericardiotomies as well as anterior transthoracic window and pleuropericardial window techniques have similar efficacies.[12] When all of

the information is examined, surgical procedures are preferred, especially for definitive therapy.

Video-assisted transthoracic pericardial drainage has been touted as being effective for preventing effusion recurrence through a large pericardial resection with the creation of a "pericardial window". However, it requires general anesthesia and single-lung ventilation which are difficult to perform on critically ill patients.[13]

Pericardiocentesis was not used electively as a diagnostic and therapeutic modality on our patients. It has incomplete diagnostic effectiveness in patients with tuberculous pericarditis and malignant processes invading the pericardium because a sufficient pericardial biopsy specimen cannot be taken. Although pericardiocentesis may provide temporary relief for patients with symptoms and signs of cardiac tamponade, it is not adequate for definitive therapy. Allen reported a series of 117 patients with cardiac tamponade resulting from PE.[14] The mortality rate in 94 patients who underwent a subxiphoid pericardiostomy was 0%, the complication rate was 1.1% (1/94), and the recurrence rate was 1.1% (1/94). Conversely, in 23 patients with PE who underwent echo-guided percutaneous catheter drainage performed by a cardiologist, the mortality rate was 4.3% (1/23), the complication rate was 17% (4/23), and the recurrence rate was 32% (7/22). These authors stated that percutaneous catheter drainage, while less invasive, is associated with increased morbidity, mortality, and effusion recurrence rates.[10,11,15]

In a series of 63 patients with cardiac tamponade who underwent primary pericardiocentesis, Bastian[10] reported a success rate of 81% and a recurrence rate of 19%. Önem et al.[16] reported significantly higher mortality (8.3%) and complication rates (16.6%) with percutaneous catheter drainage, indicating that a subxiphoidal pericardial window was a safe and effective technique for management of cardiac tamponade. In a similar study, Vayre et al.[11] reported a major complication incidence of 10%, and emergency surgical drainage was required for a failed procedure in 4% of patients. Late surgical drainage was required for the persistence or recurrence of the effusion in 15% of the patients. However, pericardiocentesis or percutaneous tube drainage may be a useful temporary treatment for patients with acute tamponade.[10,11]

A biopsy was able to define the etiology in only four (two with tuberculosis and two with neoplasia) out of 38 (11%) patients with PE as described by Fernandes.[15] In our series of 148 patients, the histopathological examination of surgical pericardial specimens defined the etiology in 27 (18.2%) patients. Moreover, the diagnosis of three of the patients with malignant processes invading the pericardium was possible only after a pericardial biopsy. We believe that a pericardiostomy may be useful for establishing the etiology of PE, especially in patients with tuberculous PE or malignancy.

The number of patients with constriction in our study was too small for statistical evaluation, but rates of recurrent effusion and constriction are higher in patients with tuberculous and other types of bacterial pericarditis. For this reason, we recommend close follow-up of these patients after the first episode.

In conclusion, we believe that a subxiphoid pericardiostomy is a safe and effective technique for treating, diagnosing, and establishing the etiology of PE, especially in patients with tuberculosis and malignant processes invading the pericardium.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Sagristà-Sauleda J, Mercé J, Permanyer-Miralda G, Soler-Soler J. Clinical clues to the causes of large pericardial effusions. Am J Med 2000;109:95-101.
2. Shabetai R. Pericardial effusion: haemodynamic spectrum. Heart 2004;90:255-6.
3. Okamoto H, Shinkai T, Yamakido M, Saijo N. Cardiac tamponade caused by primary lung cancer and the management of pericardial effusion. Cancer 1993;71:93-8.
4. Yıldız A, Yılmaz R. Kalp tamponadı. Türkiye Klinikleri J Surg Med Sci 2007;3:55-9.
5. Sugimoto JT, Little AG, Ferguson MK, Borow KM, Vallera D, Staszak VM, et al. Pericardial window: mechanisms of efficacy. Ann Thorac Surg 1990;50:442-5.
6. McDonald JM, Meyers BF, Guthrie TJ, Battafarano RJ, Cooper JD, Patterson GA. Comparison of open subxiphoid pericardial drainage with percutaneous catheter drainage for symptomatic pericardial effusion. Ann Thorac Surg 2003;76:811-5.
7. Altınbaş A, Küçüktepe Z. Perikardiyal tamponad ve perikardiyosentez. Türkiye Klinikleri J Int Med Sci 2006;2:31-8.
8. Kazak Z, Süer H, İkizler C. Good and bad luck together: a cardiac tamponade case subsequent to internal jugular vein catheterization. Türk Göğüs Kalp Damar Cer Derg 2010;18:61-3.
9. Thümmler F, Schmidt H, Evéquoz D. Pericardial effusion in the hospital-diagnosis and therapy. Praxis (Bern 1994) 1999;88:1573-80. [Abstract]

10. Bastian A, Meissner A, Lins M, Siegel EG, Möller F, Simon R. Pericardiocentesis: differential aspects of a common procedure. Intensive Care Med 2000;26:572-6.
11. Vayre F, Lardoux H, Chikli F, Pezzano M, Bourdarias JP, Koukoui F, et al. Evaluation of echo-guided pericardiocentesis in cardiac tamponade. Arch Mal Coeur Vaiss 1998;91:13-20. [Abstract]
12. Sagristà-Sauleda J, Mercé AS, Soler-Soler J. Diagnosis and management of pericardial effusion. World J Cardiol 2011;3:135-43.
13. Muhammad MI. The pericardial window: is a video-assisted thoracoscopy approach better than a surgical approach? Interact Cardiovasc Thorac Surg 2011;12:174-8.
14. Allen KB, Faber LP, Warren WH, Shaar CJ. Pericardial effusion: subxiphoid pericardiostomy versus percutaneous catheter drainage. Ann Thorac Surg 1999;67:437-40.
15. Fernandes F, Ianni BM, Arteaga E, Benvenutti L, Mady C. Value of pericardial biopsy in the etiologic diagnosis of pericardial diseases. Arq Bras Cardiol 1998;70:393-5. [Abstract]
16. Önem G, Baltalarlı A, Özcan AV, Evrengül H, Gökşin İ, Saçar M, et al. Kardiyak tamponad tedavisinde subksifoid perikardiyal pencere ve perkütan kateter ile drenaj. Turk Gogus Kalp Dama 2006;14:107-10.