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Postoperative Pericardial Effusion and Posterior Pericardiotomy, Related or Not?

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ABSTRACT

Introduction: Large pericardial effusions after cardiac surgery develop in 30% of patients and reach their maximum size on approximately day 10 postoperatively. Tamponade develops in approximately 1% of patients with large pericardial effusions. Effusion may be prevented by posterior pericardiotomy, but its role and possible adverse consequences are controversial. We sought to further investigate the effectiveness of this technique.

Method: This prospective randomized case-control study was carried out on 410 patients, mean age 68.4 ± 9.2 years, who underwent coronary artery bypass graft surgery alone or combined with valve surgery during the period between April 2005 and May 2006. A 4-cm longitudinal incision was made parallel and posterior to the phrenic nerve in the pericardiotomy group. Echocardiographic study was performed at the time of discharge and 15 and 30 days after surgery.

Results: After 15 and 30 days postsurgery, respectively, 178 (90.2%) and 192 (97%) of patients from the pericardiotomy group and none from the conventional group were free of effusion ($P < .05$).

Conclusion: Posterior pericardiotomy is easy to perform and is a safe and effective means to prevent postoperative effusion and its early and delayed adverse consequences.

INTRODUCTION

Large pericardial effusions 4 to 10 days postoperatively develop in 30% of patients and are more common in patients with excessive early bleeding after surgery and in patients who undergo cardiac transplantation [Appleton 1988]. Effusions reach their maximum size in most patients on approximately day 10 postoperatively and generally regress spontaneously after that time [Appleton 1988]. Cardiac tamponade develops in only about 1% of patients with pericardial effusion. Delayed tamponade may develop several days to weeks postoperatively. Although delayed tamponade is uncommon, it is more common among patients being treated with anticoagulants [Appleton 1988]. Delayed moderate to massive pericardial effusion and low output syndrome with renal dysfunction are encountered by all cardiac surgeons. Many published reports have addressed the role of posterior pericardiotomy in the prevention of these entities, although this technique is controversial. Therefore the aim of this study was to test the effectiveness of posterior pericardiotomy in preventing early and late (30 days postoperative) development of pericardial effusion and the possible adverse consequences of this intervention.

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METHODS

This prospective randomized case-control study was carried out on 410 patients. The mean patient age was 68.4 ± 9.2 years, 164 (40%) were male and 246 (60%) female, and the mean body mass index was 26 ± 7. Patients were divided into 2 groups, each one included 205 patients. Patients underwent coronary artery bypass graft (CABG) alone or combined CABG and valve repair or replacement during the period between April 2005 and May 2006 at Imam Tehran University Hospital.

After cardiopulmonary bypass and cardiac arrest were established, group I patients (posterior pericardiotomy group) underwent posterior pericardiotomy performed as a 4-cm longitudinal incision parallel and posterior to the left phrenic nerve, extending from the left pulmonary vein to the diaphragm. Group II patients (conventional group) did not receive a posterior pericardiotomy.

Echocardiographic study was performed by a well-known expert cardiologist for each patient just before discharge and 15 and 30 days after surgery. Grading of effusions was performed according to guidelines available at a national guideline clearinghouse (www.guideline.gov) (Table 1).

Study patients were randomly assigned to group I or II. Valve replacement and repair were carried out in 156 (38%)

Table 1. Grading of Pericardial Effusion

Grade	Description
Small	<10 mm Echo-free space in diastole
Moderate	>10 mm Echo-free space in diastole
Large	>20 mm Echo-free space in diastole
Very large	>20 mm Echo-free space in diastole plus heart compression

Table 2. Preoperative Demographic Data of Patients

Variable	Group I	Group II
Mean age, y	67.3 ± 8.2	68.2 ± 9
Sex	38% M, 62% F	42% M, 58% F
Diabetes (any type)	82 (40%)	96 (46.8%)
Hypertension	112 (54.6%)	94 (45.8%)
Elective presentation	183 (89.2%)	172 (83.9%)
Smoking (ever smoked)	156 (76%)	98 (47.8%)
Number of grafts	3.2 ± 0.9	3.3 ± 0.7
New York Heart Association class		
I	18 (8.7%)	25 (12%)
II	75 (36.5%)	64 (31.2%)
III	100 (48.7%)	95 (46.3%)
IV	12 (5.8%)	21 (10.2%)
Ejection fraction		
<35%	86 (41.9%)	91 (44.3%)
35%-55%	73 (35,6%)	87 (42.4%)
>55%	46 (22.4%)	27 (13.1%)

and 82 (20%) of group I and II patients, respectively. Preoperative demographic data of patients are summarized in Table 2.

Statistical Analyses

Results are expressed as mean ± SD. Pearson χ^2 test and Fischer's exact test were used for analyses. A P value less than .05 was considered to indicate statistical significance.

RESULTS

The study was carried out in 410 patients with a mean age of 68.4 ± 9.2 years, 164 (40%) male and 246 (60%) female, body mass index 26 ± 7, divided into 2 groups, each including 205 patients. According to New York Heart Association classification, 43 (10.4%), 139 (33.9%), 195 (47.5%), and 33 (8.04%) were in class I, II, III, and IV respectively (Table 2).

Results of echocardiographic studies are summarized in Tables 3 and 4. At the time of discharge, which was usually 5 to 6 days after surgery, 180 patients (90.9%) from group I and none of those from group II were free of effusion ($P < .05$). At postoperative day 15, 178 patients (89.8%) from group I and none of those from group II were free of effusion ($P < .05$). At postoperative day 30, 192 patients (96.9%) from group I and none from group II were free of effusion ($P < .05$). Large and very large effusions were detected only in group II. Delayed tamponade and low cardiac output were seen mainly in 2 patients from group II. Delayed tamponade did not lead to death in any patients, but the 2 patients suffered renal dysfunction, which improved gradually without the need for hemodialysis. During the course of hospitalization the mortality rate was 7 (3.4%) in group I and 11 (5.3%) in group II. Stroke was detected in 4 (1.9%) of patients in group I and 6 (2.9%) of patients in group II. Perioperative myocardial infarction was seen in 5 (2.4%) of patients in group I and 8 (3.9%) of patients in group II.

In group I patients, small pericardial effusion was detected in 20 (10.2%) 15 days after surgery and 6 (30.4%) 30 days after surgery. Of these the group I patients, in those who underwent valve surgery alone or valve surgery combined with CABG, small pericardial effusion was detected is 15 (75%) 15 days after surgery and in 5 (83.3%) 30 days after surgery.

In group II patients, moderate to very large pericardial effusion was detected in 42 (21.6%) 15 days after surgery and in 37 (19.02%) 30 days after surgery, Of these group II patients, in those who underwent valve surgery alone or valve surgery combined with CABG, moderate to very large pericardial effusion was detected in 30 (71.4%) 15 days after surgery and in 19 (64.8%) 30 days after surgery.

The mortality rate in the study patients was 4.39% (18 patients); 7 (1.7%) in group I and 11 (2.69%) in group II. The main causes of mortality in group I were stroke in 4 patients, mediastinitis in 2 patients, and perioperative myocardial infarction in 1 patient and in group II were stroke in 5 patients, mediastinitis in 2 patients, endocarditis in 1 patient, and perioperative myocardial infarction in 3 patients.

Repeat surgery for evacuation of large and very large effusions was performed just before discharge in 10 patients (5.15%), 15 days after surgery in 9 (4.63%), and 30 days after surgery in 7 (3.6%). All of these patients were from group II.

DISCUSSION

Late cardiac tamponade after open-heart surgery is a relatively uncommon but potentially serious complication. Pericardial effusion after cardiac surgery is a frequent occurrence [McKaughan 1985; Appleton 1988; Kouchouko 2003] that is more frequently seen after valve replacement [Appleton 1988; Rao 1999]. Oral anticoagulants and antiplatelet drugs may induce effusion or increase the risk of its development even weeks or months after surgery [Reddy 1990; Kouchouko 2003]. Effusions reach their maximum size in most patients approximately 10 days after surgery, generally regressing spontaneously after that time. Cardiac tamponade develops in only about 1% of patients with pericardial effusion [Kouchouko 2003]. The aim of this prospective study was to evaluate the effectiveness of posterior pericardiotomy on reducing the prevalence and severity of pericardial effusion and delayed tamponade, investigations reported in only a limited number of studies. One of these studies, which was performed in Turkey by Kuralay and colleagues between June 1996 and June 1997 at Gulhane Medical Academy, investigated the effects of

Table 3: Results of Echo Study in Group I

Grade	Discharge	15 days	30 days
Small	18 (10%)	20 (10.2%)	6 (3.03%)
Moderate	0	0	0
Large	0	0	0
Very large	0	0	0
Without effusion	180 (90%)	178 (89.8%)	192 (96.97%)

Table 4: Results of Echo Study in Group II

Grade	Discharge	15 days	30 days
Small	127 (65.46%)	152 (78.35%)	157 (80.92%)
Moderate	57 (29.38%)	33 (17.01%)	30 (15.46%)
Large	8 (4.12%)	5 (2.57%)	5 (2.57%)
Very large	2 (1.03%)	4 (2.06%)	2 (1.03%)
Without effusion	0	0	0

posterior pericardiotomy on postoperative supraventricular arrhythmia and late pericardial effusion [Kuralay 1999]. This prospective randomized study was carried out in 200 patients undergoing CABG. Patients were divided into 2 groups, each including 100 patients with or without posterior pericardiotomy. The prevalence of atrial flutter and other supraventricular arrhythmias was not statistically significant. Early and late effusions developed in 54% and 21% of patients without pericardiotomy, respectively, but neither early nor late effusions developed in patients with posterior pericardiotomy ($P = .00001$). The occurrence of delayed tamponade was also significantly lower in those with pericardiotomy (0% vs 10%, $P = .001$). These investigators concluded that posterior pericardiotomy is technically easy to perform and a safe, effective technique that reduces not only the prevalence of early pericardial effusion and related atrial fibrillation but also delayed pericardial effusion and tamponade [Kuralay 1999].

Another investigation of 100 patients undergoing CABG, performed at the department of cardiac surgery in Bristol Royal Infirmary, UK, was a prospective study to demonstrate the effectiveness of pericardiotomy in reducing the incidence of pericardial effusion and, consequently, reducing the incidence of supraventricular arrhythmia in the postoperative period. Pericardial effusion occurred in 4 of 50 patients following posterior pericardiotomy, a statistically significant result ($P < .0005$). Supraventricular arrhythmias occurred in 4 patients in the pericardiotomy group and 18 patients in the group without pericardiotomy ($P < .005$). These investigators concluded that pericardiotomy is a simple, safe, and effective method of reducing the incidence of pericardial effusion and thereby postoperative supraventricular arrhythmia and delayed slow-growing tamponade [Mulay 1995].

Echocardiographic results for our study are summarized in Tables 3 and 4. No mortality was attributable mainly to tamponade. All of the patients with moderate, large, and very large pericardial effusion were from group II ($P < .05$). During the postoperative period, all of the patients who had to undergo repeat surgery for evacuation of their large and very large effusions were in group II, a result that further highlights the importance of posterior pericardiotomy in preventing delayed effusion and its adverse consequences. The statistically significant differences between the 2 groups demonstrate that posterior pericardiotomy after any cardiac surgery, and especially after valve surgery alone or combined with other cardiac surgery, is easy to do, safe, and very effective for reducing the incidence and severity of postoperative pericardial effusion and thereby delayed tamponade and its adverse consequences. Therefore, routine performance of posterior pericardiotomy is recommended after any cardiac surgery, and particularly surgery that involves valve replacement or repair.

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