Original Article

Efficacy of Posterior Pericardiotomy to Prevent Postoperative Pericardial Effusion after Valvular Heart Surgery

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ABSTRACT

Objective: To determine the effect of posterior pericardiotomy to prevent postoperative pericardial effusion.
Study Design: prospective observational study
Place and Duration of Study: This study was conducted at the Chaudhary Pervaiz Elahi (CPE) Institute of Cardiology, Multan, Pakistan, from January 2019 to August 2020.
Materials and Methods: Patients who underwent mechanical valve replacement surgery and posterior pericardiotomy at time of surgery were included in the study group (Group 1) and patient in whom posterior pericardiotomy was not done during valve replacement surgery were taken as a control group (Group 2). Perioperative characteristics of all patients were recorded. Primary end-point of the study was postoperative large pericardial effusion which needs surgical drainage.
Results: 2,399 patients were operated for cardiac diseases, out of which 520 (21.6%) patients underwent valve replacement surgery. Posterior pericardiotomy was done at time of surgery in 70 patients. There was no difference between the two treatment groups with regard to age, sex, LV ejection fraction, preoperative pulmonary pressure, operation type, cross clamp time and CPB time. 21 patients (4.67%) developed postoperative large pericardial effusion in control group. However, it was not statistically significant (p >0.065). Operative mortality of pericardial effusion drainage was 19%.
Conclusion: We concluded that Posterior Pericardiotomy at time of valve replacement surgery is a safe and effective technique to prevent postoperative Pericardial Effusion.
Key Words: Posterior pericardiotomy, Postoperative pericardial effusion

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INTRODUCTION

Rheumatic heart disease is still common in developing countries like Pakistan. Patients with severe valve disease undergo valve replacement surgery.[1] Patients having mechanical prosthetic valve need lifelong anticoagulation therapy after surgery to avoid valve thrombosis. These patients are prone to develop postoperative pericardial effusion (POPE).[2,3] Literature review revealed that 4.5-6% patients develop clinically significant Pericardial effusion after valve surgery.[4,5]

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Despite improvements in perioperative care, pericardial effusion is an important cause of morbidity and mortality after surgery. Up to 19% mortality is reported among patients who needs pericardial effusion drainage.[2,6] Postoperative PE may present with nonspecific clinical symptoms which may be easily missed in early postoperative follow up period resulting in delayed diagnosis and treatment.[2,7,8]

Posterior pericardiotomy is a technique whereby a window is created between pericardium and left pleural cavity to prevent any fluid accumulation in pericardial cavity, this simple technique may help to reduce the incidence of lethal cardiac tamponade after valvular heart surgery.[9]

Although the effect of posterior pericardiotomy (PP) in reducing the incidence of late pericardial effusion after valve replacement surgery is reported by Erdil et al.[10] but so far, scarcely any center is performing this procedure in valve patients routinely, suggesting that there is not yet sufficient awareness in this regard.

Therefore, we aimed to evaluate the role of Posterior Pericardiotomy to prevent postoperative pericardial effusion and its complications in patients having valve replacement surgery.

MATERIALS AND METHODS

From January 2019 to August 2020, patients undergoing isolated or concomitant mechanical valve replacement surgery at Department of Cardiac surgery, Chaudhary Pervaiz Elahi Institute of cardiology Multan were included in the study.

Patients were divided into two groups; in Group 1 posterior pericardiotomy was done during surgery and in Group 2 no posterior pericardiotomy was done.

Following patients undergoing valve replacement surgery were excluded from study group:

Exclusion criteria:

- Patients having left pleural adhesions
- Inability to do posterior pericardiotomy because of thick calcified adhesions of heart to posterior pericardium
- cardiac tamponade within 48 hours of cardiac surgery due to excessive surgical bleed in the presence of mediastinal drains.

The study was conducted after approval from the ethical committee of the institution and according to the rules established by the revised Helsinki convention.

In Group 1, Posterior pericardiotomy was done during surgery by our own method. After cardioplegic arrest of heart before replacing the valve, heart was lifted and retracted by surgeon to expose posterior pericardium. Then Posterior Pericardium was grasped with Ellis's forceps at its most dependent part in supine position medial to the phrenic nerve and lateral to descending aorta, 3-4 cm longitudinal incision was made with electrocautery to create a window between pericardium and left pleural space. Care was taken to position incision on posterior pericardium proximal to LV apex to avoid any speculated risk of cardiac herniation through this incision into left pleural cavity. (Fig I).

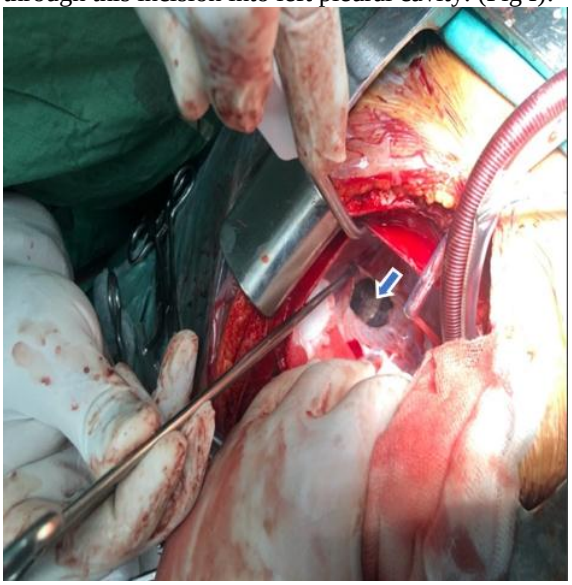

Figure No.1: Arrow points the pericardio-pleural window after posterior pericardiotomy

Two chest tubes, one in the left pleural cavity and the other in anterior mediastinum, were placed in Group 1. In Group 2, chest drain was placed in anterior mediastinum and in pleural cavity only when it was entered. No posterior mediastinal drain was used in either group.

Chest tubes were removed on the following day when the drainage was nil for two hours or less than 10 mL/h for consecutive 4 hours, no air leak and no mediastinal or pleural collection confirmed by x-ray chest and echocardiography. Rest of surgical technique used in both groups was same. Conventional median sternotomy was performed in all patients. Sodium warfarin was used for anticoagulation which was started on the first postoperative day. Sodium warfarin dose was adjusted daily to achieve therapeutic INR in range of 2.5-3.5. Anti-platelet medication was routinely added in all patients. We did not use heparin as a bridge therapy during achievement of therapeutic INR. Echocardiographic evaluation for presence of pericardial effusion was made by a cardiologist of senior registrar rank at time of discharge. Patients were followed for 6 weeks for pericardial effusion. Echocardiography was done when there was any clinical suspicion of pericardial effusion during follow up period. Pericardial effusion was graded using the criteria described by Bakhshandeh et al.

Grade	Description
Small	<10 mm echo-free space in diastole
Medium	10 mm echo-free space in diastole
Large	20 mm echo-free space in diastole
Very Large	20 mm echo-free space in diastole with compression of the heart

Pericardial effusion of 2cm or above was considered as clinically significant and needed drainage.

Primary outcome was cardiac tamponade or large pericardial effusion within 6 weeks after surgery. Secondary outcome was presence of left sided pleural effusions in patients and mortality associated with pericardial effusion drainage.

The data was entered and analyzed using SPSS (statistical package for social Sciences) version 25.0. Quantitative variables were expressed as mean ± standard deviation and the qualitative variables were expressed as frequency and percentage. Difference between groups was assessed by independent student t test or chi square contingency analysis. P values < 0.05 was considered statistically significant.

RESULTS

From January 2019 to August 2020, *2399* patients were operated for cardiac diseases at cardiac surgery department CPEIC, Multan, out of which 520 (21.6%)

patients underwent valve replacement surgery. Depending upon surgeon discretion and preference, in 70 patients posterior pericardiotomy was done at time of valve surgery and no posterior pericardiotomy in 450 patients undergoing valve replacement surgery. There was no difference between the two treatment groups with regard to age, sex, LV ejection fraction, Left ventricle end-diastolic dimension, preoperative pulmonary pressure, functional class, cross clamp time, CPB time, ventilation time and hospital stay as shown in table I and table 2. 21 patients (4.67%) out of 450 patients in group 2 (control group) developed postoperative large pericardial effusion which needed drainage after primary surgery on follow up and none of the patients who had posterior pericardiotomy during valve replacement surgery developed postoperative large pericardial effusion.

Table No.1: Quantitative Variables

Variables	Group	Mean	Std.Deviation	P value
Age	1	30.4714	11.55042	0.530
	2	29.0622	12.59850	
Pulmonary hypertension	1	59.843	21.3288	0.734
	2	60.673	22.1636	
EF	1	55.7143	6.32946	0.712
	2	56.3556	5.81319	
Creatinin	1	.9129	.25647	0.489
	2	.9398	.23886	
LVIDD	1	60.2286	11.00879	0.937
	2	60.5511	10.97307	
CPB time	1	100.1714	29.61344	0.927
	2	99.4178	29.46061	
Clamp time	1	77.8000	25.88021	0.976
	2	77.5933	25.68910	
VT	1	7.0000	3.61158	0.932
	2	6.9978	3.56455	
Hospital stays	1	5.1714	.97760	0.771
	2	5.1844	.97598	

EF=Ejection Fraction, LVIDD=Left ventricle internal diastolic dimension, CPB=cardiopulmonary bypass VT=ventilation time

Table No.2: Qualitative Variables

Variable	Group 1	Group 2	Pvalue
Gender			
Male	40	250	0.804
Female	30	200	
NYHA Class			
II	9	81	0.565
III	53	318	
IV	8	51	
Pericardial Effusion			
Yes	0	21	0.065
No	70	429	
Pleural Effusion			
Yes	1	5	0.817
no	69	445	

Symptomatic large pericardial effusion was drained by surgical exploration under anaesthesia by subxiphoid approach. The postoperative large pericardial effusion was more in control group. However, this difference was not statistically significant (p >0.065). There was no significant difference regarding the postoperative left pleural effusion.

Out of 21 patients how developed postoperative large pericardial effusion 4 patients expired. (mortality among pericardial effusion=19%). This raises the operative mortality 0.9% in group 2.

DISCUSSION

Postoperative Pericardial effusion is a well-known complication after open heart surgery[4]. Different operative strategies and drugs are used to prevent early postoperative pericardial collection and cardiac tamponade like opening of left pleura, placing posterior mediastinal drain and use of anti-inflammatory drug like colchicine[11,12,13]. Literature review revealed no clear benefits of these strategies to prevent cardiac tamponade. Erdil's group suggested that posterior cardiotomy during valve replacement operation might reduce the risk of cardiac tamponade and postoperative pericardial effusion, but they failed to show statistically significant difference. Postoperative pericardial effusion has been associated with anticoagulant use and post pericardiotomy syndrome.[14,15] Large effusion may surround the heart, but the most frequently it is localized posterior to the heart.[15] Posterior Pericardiotomy is considered an important operative strategy that can remarkably diminish the incidence of postoperative pericardial effusion and tamponade.[16] Results of our study are similar to a study done by Nevzat Erdil et al which showed that incidence of postoperative pericardial effusion is less after posterior pericardiotomy but the difference was not statistically significant. There is conflicting data about safety of this strategy some study highlighted that pulmonary complications and left pleural effusion is more in posterior pericardiotomy group and other study showed no difference[9,10]. In our study there is no difference in occurrence of left pleural effusion in both groups. In all patients with PP, a chest tube was placed in left pleural cavity, there was no untoward effect like herniation of heart was noted in our study. Some surgeons may use sharp incision on posterior pericardium. We preferred low-powered electrocautery incision between left phrenic nerve and descending aorta. Our study showed that the incidence of clinically significant postoperative large pericardial effusion in patients without posterior pericardiotomy was 4.67 % which was similar to study done by Pepi M et al and a study done by sang chang chu and colleagues.[4,17]

Although many studies[18,19,20] have showed that posterior pericardiotomy is safe and effective treatment in preventing postop pericardial effusion but none of the study have highlighted the survival advantage of posterior pericardiotomy. In our study we have noted that although the difference of large POPE is not

significant among groups, but even after successful primary surgery this lethal complication increases the operative mortality nearly 1% in control group. And mortality among patients who need pericardial effusion is remarkably high up to 19%. This high mortality in patients who need POPE drainage is reported in literature.[2,6]

The limitation of study is that a smaller number of patients are in study group as compared to control group. To strengthen the conclusion a randomized trial is needed. Only those patients who underwent surgical drainage are seen for large postoperative PE complication, those patients how expired at their homes or cannot reached at tertiary care centers have been missed.

In summary Posterior pericardiotomy is useful in sub-continent countries where surgery for rheumatic heart disease is still a big health burden. In these developing countries with limited health resources and infrastructure, patients have to visit for follow up in tertiary care centers from remote areas with no health facilities. So, efforts should be made to avoid this early lethal complication.

CONCLUSION

We concluded that posterior pericardiotomy during valve replacement surgery is a safe and effective technique to prevent postoperative pericardial effusion and mortality associated with it.

Author's Contribution:

Concept & Design of Study:	Muhammad Sher-i-Murtaza
Drafting:	Muhammad Hamid Chaudhary, Iftikhar Paras
Data Analysis:	Iftikhar Paras, Ahmad Abdul Manan
Revisiting Critically:	Muhammad Sher-i-Murtaza, Muhammad Hamid Chaudhary
Final Approval of version:	Muhammad Sher-i-Murtaza

Conflict of Interest: The study has no conflict of interest to declare by any author.

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