



Original Article

Is the Posterior Pericardial Window (PPW) Has a Prophylactic Role Against Post Heart Valve Surgery Pericardial Tamponade?

Amr Hassan Mansour^{1*}, Amany gouda mohammed ibrahim², Islam Elsayed Shehata³, Mohamed Mamdouh Elsharawy⁴, Amr El Sayed Tawfek⁵

^{1, 2, 4, 5} Cardiothoracic Surgery Department, Zagazig University, Egypt.

³ Cardiology Surgery Department, Zagazig University, Egypt.

*Corresponding author:

Amr Hassan Mansour.
Cardiothoracic Surgery
Department, Zagazig University,
Egypt.

E-mail:

amrh_man78@yahoo.com

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ABSTRACT

Background: Cardiac tamponade after heart surgery is of great concern. It increases perioperative mortality and morbidity. Late tamponade might be easily missed and difficult to be diagnosed clinically. It is thought that posterior pericardial window decreases the incidence of postoperative tamponade.

Aim of the work: The aim of the study to evaluate the prophylactic role of posterior pericardial window (PPW) in preventing pericardial tamponade after heart valve surgery.

Methods: Our prospective randomized comparative study included 640 patients collected by simple random sampling. All patients were admitted in cardiothoracic surgery department-Zagazig University hospitals-Egypt, from January 2020 to May 2022. They were divided into PPW group and non-PPW group and each group contains 320 patients.

Results: There is statistical significant difference as regrading occurrence of late tamponade between both groups and also less developed new onset atrial fibrillation in PPW group.

Conclusions: Pericardial window is easily to be performed technically. We recommend that procedure to prevent late pericardial effusion and tamponade as it provides a good drainage pathway between pericardial and pleural cavities. We consider that technique is valuable for patients with coagulation disorders.

Key words: Posterior Pericardial Window, Pericardial Tamponade, Heart Valve Surgery.



INTRODUCTION

Pericardial effusion (P.E) that occurs after open heart surgery is usually insignificant. Cardiac tamponade after these operations is of great concern as it increases perioperative mortality and morbidity¹. Anticoagulant and antiplatelet therapy as well as postpericardiectomy syndrome after heart surgery are predisposing factors of pericardial effusion. Pericardial effusion and tamponade may occur with no obvious signs

clinically². Effusion and tamponade are classified into early and late. Late one is rarely to be diagnosed and may be easily missed with higher mortality. Late tamponade is likely to occur more commonly after heart valve surgery compared to coronary bypass cases³. Effusion is most frequently localized posteriorly behind left ventricle. Posterior pericardiectomy reduces the incidence of pericardial effusion and atrial fibrillation after coronary artery bypass surgery⁴.

AIM

The aim of the study is to evaluate the prophylactic role of posterior pericardial window PPW in preventing pericardial tamponade after heart valve surgery.

METHODS

Our prospective randomized comparative study included 640 patients collected by simple random sampling. Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans. All patients were admitted in cardiothoracic surgery department-Zagazig University hospitals-Egypt, from January 2020 to May 2022. They were divided into two groups group (1) PPW group and group (2) non PPW group and each group contains 320 patients.

Inclusion criteria

Heart valve surgery, either repair or replacement.

Exclusion criteria

Combined CABG-valve surgery, previous sternotomy or cardiac surgery and previous lung surgery.

Preoperative measures

Patients history and their physical examination were done. Laboratory investigations, particularly, coagulation profile and also echo cardiography were done. Preoperative evaluation, anaesthetic drugs and surgical measures in both groups of the study were the same. For patients who were using warfarin preoperatively. We lowered the International Normalized Ratio (INR) using fresh frozen plasma. We did not use heparin as a bridge for patients till surgery time. Median sternotomy was done for all patients. 300 units/kg of heparin was given after the pericardium was opened. Through the cardiopulmonary bypass (CPB), Activated clotting time (ACT) values were reserved above 450 sec. Protamine sulphate (1 mg for 100 units) was given to reverse heparin sodium at the end of CPB. For all patients, roller pump and membranous oxygenator had been used. Systemic hypothermia (28°C) was maintained during CPB. Moderate Hypothermia in the range of 22°C inhibits

the effect of thrombin on platelet activation and aggregation.

.Group I (posterior pericardial window group (PPW):

Creating a window was done before fixing the prosthetic materials to avoid mechanical complications and atrioventricular rupture when lifting up the apex of the heart. The left pleura was widely opened. The phrenic nerve was identified to avoid its injury during incision by putting a hand and pushing the posterior pericardium forwards when required. The heart apex was raised up by using sponge to hold it. Allis forceps was used to hold the posterior pericardium at a free point. 3-4 cm reversed T incision was done extend from left inferior pulmonary vein to diaphragm. With cauterization of the cut edges of the pericardium, then the valve surgery done. One retrosternal 40 F and pleural 32F drains were fixed. The retrosternal drain was removed when the amount of the drain was less than 100ml/24 h and serous in nature then the pleural one was removed after patients mobilization, the amount of drain less than 100ml/24 h and serous in nature and chest x ray was accepted.

Group II (non posterior pericardial window group (non PPW)

Valve surgeries had been done without creating posterior pericardial window. Two mediastinal drains were inserted size 40 F and were removed in I.C.U when the drain less than 100ml/24 h and serous in nature.

Echocardiography for follow up of both groups was done on the 2nd postoperative day, pre discharge, then one month later and after 3 months by the same cardiologist.

STATISTICAL ANALYSIS

Data were collected and entered on microsoft excel sheet. Analysis was done by SPSS version 20.0 software, continuous data were summarized by means and standard deviation where categorical variables were described by number and percent. A two-tailed $p < 0.05$ was considered statically significant

RESULTS

Patients demographics

The average age of our patients was 42±16 years in first group and 38±16 years in the second group, Male patients represented 40% (92 patients) in first group and 54.8% (126 patients) in second group without significant difference between both groups. There are multiple observed co morbidities discovered among patients hypertensive(92:81) patients ,diabetic(58:46)patients ,C.O.P.D(46:58)patients and renal diseases (12:6)patients respectively in each group without significant difference between both groups , Ejection fraction is divided into good ≥ 50% (184:184)patients ,moderate 50-35%(35:23)patients and poor≤35%(11:23)patients respectively in each group without significant difference between both groups . NYHA is divided into class I (184: 184) patients, class II (23:35)patients and class III(23:11)patients respectively in each group without significant difference between both groups. As regard warfarin use 196 patients (85%) in 1st group and 184 patients (80%) in 2nd group without significant difference between both groups. As regard Low Ht value 35 patients (15.2%) in 1st group and 23 patients (10%) in 2nd group without significant difference between both groups.

Table (1): Preoperative characteristics of patients in both groups

As regard operative procedures done AVR (56:46) patients, MVR (69:81) patients, DVR(35:35) patients, TVR(23:11) patients, MVr (12:23), MVR+TVr (12:23) patients, DVR+TVr (23:11) patients respectively in each group without significant difference between both groups patients .Total drain(ml) was 836±615 ml in 1st group and 863±587 ml in 2nd group without significant difference between both groups. As mortality were 3 patients (1.3%) in 1st group and 4 patients (1.7%) in 2nd group due to stroke without significant difference between both groups. Early exploration occurred in 46 patients (25%) in 1st group and 46 patients (20%) in 2nd group without significant difference between both groups. But late pericardial tamponade occurred in 12 patients (5.2%) in 1st group (PPW) and 92 patients (40%) in 2nd group non-PPW with significant difference between both groups that give a prophylactic role against post heart valve surgery pericardial tamponade, we classify postoperative tamponade into early which occur in the 1st 72h postoperative and late tamponade which occur in the 5th day or later. Pulmonary complications in the form of atelectasis

and mild effusion occurred in 46 patients (20%) in 1st group and 35 patients (15%) in 2nd group without significant difference between both groups and arrythmia inform of new onset. AF occurred in 23 patients (10%) in 1st group and 35 patients (15%) in 2nd group without significant difference between both groups table (2).

Table (1): Preoperative characteristics of patients in both groups

	group (1)	group (2)	P-value
age	42±16	38±16	N.S
Sex			
female	138(60%)	104(45.2%)	N.S
male	92(40%)	127(55.2%)	N.S
Comorbidity			
hypertension	92(40%)	81(35.2%)	N.S
Diabetes mellitus	58(25.2%)	46(20%)	N.S
C.O.P.D	46(20%)	58(25.2%)	N.S
Renal insufficiency	12(5%)	6(2.6%)	N.S
Ejection fraction			
good ≥ 50%	184(80%)	184(80%)	N.S
moderate 50-35%	35(15.2%)	23(10%)	N.S
poor≤35%	11(4.8%)	23(10%)	N.S
N.Y.H.A class			
class I	184(80%)	184(80%)	N.S
class II	23(10%)	35(15.2%)	N.S
class III	23(10%)	11(4.8%)	N.S
Warfarine use	196(85%)	184(85%)	N.S
Low Ht.	35(15.2%)	23(10%)	N.S

NS =non-significant.

Table (2): intra, post operative and follow up data.

	group (1)	group (2)	P-value
operative procedure			
AVR	56(24.4%)	46(20%)	N.S
MVR	69(30%)	81(35.2%)	N.S
DVR	35(15.2%)	35(15.2%)	N.S
TVR	23(10%)	11(4.8%)	N.S
MVr	12(5.2%)	23(10%)	N.S
MVR+TVr	12(5.2%)	23(10%)	N.S
DVR+TVr	23(10%)	11(4.8%)	N.S
Total drain(ml)	836±615	863±587	N.S
Mortality			
Early exploration	46(20%)	46(20%)	N.S
Late temponade	12(5.2%)	92(40%)	s

Pulmonary complication	46(20%)	35(15%)	N.S
Arrythmia	23(10%)	35(15%)	N.S

NS =non-significant.S = significant.

DISCUSSION

Postoperative pericardial effusion is a common complication after cardiac surgery. Using postoperative anticoagulation is a major contributing factor to the occurrence of the pericardial effusion that leads to cardiac tamponade after cardiac surgery⁵. Malouf et al. reported that the rate of tamponade increased to 27% when extreme doses of anticoagulants were used. Late cardiac tamponade was reported in several studies to be more common in valve surgery cases than in coronary artery bypass grafting cases⁶, Kuvin et al. reported 0.6 vs 0.2%⁷, Aksöyek et al. reported 3.4 vs 0.1%⁸, and Meurin et al. reported 11% vs 2%⁹. It has been reported that the incidence of cardiac tamponade ranges from 1% to 31% according to the type of cardiac surgery. Early tamponade occurs within 1st 24 hours but late tamponade develops after 5th day postoperatively which is difficult to be diagnosed¹⁰.

PPW is thought to be a good choice procedure to prevent tamponade in cardiac surgery especially valve cases. Some surgeons prefer not to open the pleura, believing that may affect the respiratory condition postoperatively. Also, phrenic nerve injury is one of the complications of PPW that is why those surgeons prefer not to do. The effect of the opened pleurae with open heart surgery on the reduction of pulmonary function tests¹¹, Omeroglu et al. had studied two groups of patient, one with open pleurae and the other patient group with intact integrity of both pleurae, and found that postoperative pulmonary function was reduced significantly in both groups.

They documented that the incidence of atelectasis and pneumothorax was increased in the group with opened pleurae, with no significant changes in pulmonary function tests, arterial blood gases and other postoperative findings between the two groups¹¹.

In our study, open pleura came up with a very significant reduction of cardiac tamponade with no significant increase of pulmonary complications. No phrenic nerve injury occurred with any of our patients. In literature, there are documents that opening of the pleural space anteriorly reduced early tamponade other. Other studies had the contrary view. Cenal et al., with patients who were taken into early revision because of bleeding, documented that

opening the pleura to harvest the internal mammary artery during coronary artery bypass grafting did not decrease the incidence of tamponade. No information in the literature that opening the pleura guards against late tamponade. Mostly, accumulating fluid in the posterior pericardial cavity is trapped and cannot pass the pleural space anteriorly that leading to late tamponade¹¹.

Kuralay et al¹². and Mulay¹³ et al. studied two groups of patients, all patients had left pleura opened for mammary artery harvesting. In their studies, late effusion and tamponade were not found in patients with PPW group, but found in patients with only opened left pleura.

In our study, early exploration for patients with tamponade within 1st 24 hours who had bleeding in the first postoperative hours and instability of hemodynamics with mediastinal widening during the following hours. Cases with late tamponade, there were no bleeding in the early postoperative time, no clinical or radiological findings that suggest tamponade. Both cases of early and late tamponade were explored, fresh blood and large amount of fresh thrombus found in early cases but in late ones there was defibrinated blood with no fresh blood nor thrombi. There was insignificant difference between the groups in our study. Two types of cardiac tamponade can happen after open-heart surgery. The early type is seen during the first 48 hours after an surgery and the delayed or latent type which usually occurs after the 5th postoperative day and may occur as late as 30 days postoperatively². Death was due to multiorgan failure because of poor cardiac function and prolonged I.C.U recumbency as deterioration in cerebral stroke cases. Early exploration of cases of tamponade and early drainage gives good outcome. Delayed management of tamponade leads to fatal outcome.

Aksöyek et al¹⁴. reported a mortality rate of 3.5% associated with the tamponade drainage. In our study, there was no mortality with cases who had early reexploration for bleeding. The study by Kuvin et al⁷ documented that surgical bleeding or coagulopathy due to cardio-pulmonary bypass are predisposing factors of early cardiac tamponade after open heart surgery. Predisposing factors have of late tamponade are, female gender, anticoagulant use preoperatively, decreased preoperative haematocrit levels, coagulopathy, autoimmune reactions and epicardial pacer wires removal¹³.

In our study, epicardial pacing wires were removed by the 5th day and follow up echocardiography was done 24 hours later. Anticoagulant doses were

started very gradually under cover of heparin to guard against unexpected increase of INR level.

The study done by Erdil et al between 2001 and 2003 reported that posterior pericardiectomy had reduced early and late pericardial effusion and tamponade in valve replacement patients¹⁵.

In our study, pericardial window has decreased the incidence of tamponade. It prevents fluid accumulation in the pericardium that may trigger arrhythmias mechanically by stimulating the atria. We observed that the incidence of atrial fibrillation was decreased in the window group which was observed also by Farask et al¹⁶.

CONCLUSIONS

Pericardial window is easily to be performed technically. We recommend that procedure to prevent early and late pericardial effusion and tamponade as it provides a good drainage pathway between pericardial and pleural cavities. We consider that technique is valuable for patients with coagulation disorders.

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