

Evaluation of the results and complications of posterior pericardiotomy in coronary artery bypass graft surgery at Farshchian Heart center in Hamadan

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ABSTRACT

Introduction: Postoperative bleeding, pericardial effusion and arrhythmia (especially atrial fibrillation) are among the most common and important postoperative complications of CABG.

Postoperative pericardial effusion can cause tamponade and also increases the incidence of atrial fibrillation. Posterior pericardiotomy is performed to reduce the incidence of pericardial effusion and its complications. This study aimed to investigate the results of posterior pericardiotomy in coronary artery bypass grafting surgery.

Material and Methods: In this descriptive / cross-sectional study, 145 patients undergoing coronary artery bypass grafting at Farshchian Heart center from March 2019 until March 2020 were selected by convenience and consecutive sampling method and examined for early results of posterior pericardiotomy. Data were analyzed using SPSS software version 16 at 95% confidence level.

Results: The mean age of patients was 63.96 years, 75.2% were male and 24.8% were female. 91% of operations were elective and 55.9% were on pump CABG. The incidence of postoperative Atrial fibrillation was 9.66%, pericardial effusion was seen in 3.36% patients, which was mild in 2.67% and moderate in 69% cases. Tamponade was not seen in any case. The overall mean drainage of all chest drains from the beginning to the time of drain removal, was about 795±409 cc.

Conclusion: Posterior pericardiotomy is a simple and safe method of draining posterior pericardial space that may be effective in reducing the incidence of atrial fibrillation, pericardial effusion and pleural effusion after coronary artery bypass grafting

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Introduction

Coronary artery bypass grafting (CABG) surgery is one of the most common and

effective methods for treating coronary artery disease (1).

Postoperative bleeding, pericardial effusion and arrhythmia (especially atrial fibrillation)

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are among the most common and important postoperative complications (2-7). Postoperative pericardial effusion can cause tamponade and also increases the incidence of atrial fibrillation (5-9). Clinically insignificant pericardial effusion is common following CABG and other open heart surgeries. Depending on the methodology used for its detection, pericardial effusion have been reported in 4.7 to 85% and cardiac tamponade in 0 to 8.8% of patients (9). Distribution of pericardial effusion based on echocardiography as: Mild fluid accumulation: as a fluid accumulation with a diameter of less than 10 mm Moderate fluid accumulation: as a fluid accumulation with a diameter between 10-20 mm Severe fluid accumulation: Defined as fluid accumulation with a diameter greater than 20 mm (10). After heart surgery, proper drainage of the pericardial cavity is not usually performed, especially in the posterior part. On the other hand, implantation of a drain inside the pericardial space is sometimes not possible in cases of coronary bypass because it may cause pressure on the grafts (6,11,12). Providing a suitable method for discharge of pericardial cavity after open heart surgery prevents or reduces the above mentioned problems (16). Posterior pericardiotomy (PP) means creating a window from the posterior part of the pericardium space into the left pleural space, which is performed by the surgeon at the end of the operation to reduce the probability of fluid accumulation within the pericardial space and can reduce the incidence of pericardial effusion and its complications.

This study was performed to evaluate the positive effects of posterior pericardiotomy on the incidence of pericardial effusion, atrial fibrillation, and tamponade after coronary artery bypass graft surgery at Farshchian Heart center in Hamadan in 1998.

Materials and Methods

In this descriptive / cross-sectional study, 145 patients undergoing coronary artery bypass grafting at Farshchian Hospital in Hamadan from March 2019 until March 2020 were selected by convenience and consecutive sampling method and examined for early results of posterior pericardiotomy.

Inclusion criteria were all isolated coronary artery bypass grafting operation in which Posterior pericardiotomy was performed. Exclusion criteria were Presence of arrhythmia before surgery, renal failure, Preoperative coagulation disorders and significant liver disease. Pulmonary function testing (PFT) is performed in all patients before surgery. The coronary bypass surgery was either off-pump or on-pump, depending on the patient's condition and the surgeon's preference. All surgeries were performed by one surgeon.

Coronary artery bypass graft surgery is performed according to the usual and standard method. In a limited number of cases, the right pleura was inadvertently opened during a sternotomy. The pleura were repaired, so no drain was used in the right pleural space. In all patients, the left pleura was opened by the surgeon at the time of LIMA harvesting. Posterior pericardiotomy is performed after cross clamp removal and in the cases of off pump bypass surgery; this is done after the anastomosis of the grafts is completed. For Posterior pericardiotomy, a 4 cm incision is made posterior and parallel to the phrenic nerve from the left inferior pulmonary vein to the diaphragm, creating a circular or oval opening into the left pleural cavity. At the end of the operation, a drain is placed in the left pleural space and the next drain is placed below the sternum to drain the cumulative fluid. Also, in limited cases where there is no graft in the poster lateral surface of the heart, a pericardial drain may be inserted. Based on previous studies (6, 11, 12), we applied following formula to calculate the size of the studied population. Accordingly, we estimated the sample size to be 145 cases for this study. Using a systematic random sampling, we selected. Data were analyzed using IBM SPSS software version 16 at 95% confidence level. Firstly, descriptive statistics indices (dispersion and central indices) were calculated. For analytical statistics, after examining the normality of the data, T-test and Mann-Whitney U tests were utilized to investigate the relationship between Posterior pericardiotomy and tamponade and. the logistic regression model was also used to control the confounding variables to

determine the relationship between the independent variable and the dependent variables. P value less than 0.05 was considered significant.

Results

Out of 145 patients, 109 (75.2%) were male and 36 (24.8%) were female. The mean age of patients was 63.96 years, the minimum age was 43 and the maximum was

84 years. (0, 05%) 44.1% of the operation was off pump CABG and 55.9% was on pump. In terms of operation schedule, 9% was emergency and 91% was elective operations. Out of a total of 145 bypass operations, 64(44.1%) were off pump surgery and 81(55.9%) were on pump surgery. (Table1-3).

Table 1: Frequency distribution of coronary artery disease (CAD) risk factors

| Risk factor | Number | Percentage |
|---------------------------------|--------|------------|
| Diabetes | | |
| Yes | 53 | 36.6 |
| No | 92 | 63.4 |
| Hypertension | | |
| Yes | 86 | 59.3 |
| No | 59 | 40.7 |
| Hyperlipidemia | | |
| Yes | 49 | 33.8 |
| No | 96 | 66.2 |
| Smoking | | |
| Yes | 44 | 30.3 |
| No | 101 | 69.7 |
| Family history of CAD | | |
| Yes | 55 | 37.9 |
| No | 90 | 62.1 |
| BMI \geq 30 | | |
| Yes | 25 | 17.3 |
| No | 120 | 82.7 |
| MI | | |
| Yes | 38 | 62.2 |
| No | 107 | 73.8 |

BMI, Body Mass Index; MI, Myocardial Infarction.

In our study of 145 patients, only 5(3.36%) patients had pericardial effusion during hospitalization, which was mild in 4(2.67%) cases and moderate in one case(.69%). Tamponade was not seen in any case. In a patient with moderate pericardial effusion, diuretic and anti-inflammatory drugs were administered for two weeks. No intervention was required in any case and in echocardiography during two months after surgery there was only one case of mild pericardial effusion. In the early postoperative period, 3(2.06%) patients required draining of pleural fluid.

Atrial fibrillation occurred during hospitalization in 14 patients (9.66%), which in one case was converted by D/C shock and in other cases by ant arrhythmic drugs.

Pleural effusion was seen in 4(2.75%) patients during hospitalization. In On Pump surgery, the mean duration of cardiopulmonary bypass was 88.30 minutes and the mean duration of aortic clamp was 53.17 minutes. The incidence of atrial fibrillation, pericardial effusion and pleural effusion were 9.66%, 1.38% and 2.76%, respectively. The drained discharge was 795.71 cc, the mean postoperative extubation time was 14.73 hours, the mean hospitalization time in ICU1 and post ICU ward and total hospitalization time were 2.04 and 2.04 and 5.14 respectively (Table3,4).

Table 2: Frequency distribution of ejection fraction (EF) in patients

| Ejection Fraction (EF) | Evaluation time | | |
|------------------------|------------------|--|---------------------------------------|
| | Before operation | During the postoperative hospital stay | Control echo, one month after surgery |
| Average | 42.69 | 42.10 | 41.63 |
| Standard deviation | 8.40 | 8.22 | 8.31 |
| Minimum | 20 | 20 | 20 |
| Maximum | 55 | 50 | 55 |

Table 3: Operative data

| Variable | Frequency | |
|-------------------------------------|---------------|---------------------------|
| | Number | Percentage |
| Pump | | |
| Off pump | 64 | 44.1 |
| On pump | 81 | 55.9 |
| Timing of operation | Number | Percentage |
| Emergent/urgent | 13 | 9.0 |
| Elective | 102 | 91.0 |
| Bypass(CPB) time | Mean | Standard deviation |
| Minute | 88.30 | 18.97 |
| aortic cross clamp(ACC) time | Mean | Standard deviation |
| Minute | 53.17 | 14.54 |

Table4: Frequency distribution of postoperative pericardial effusion cases

| Pericardial effusion | Evaluation time | | |
|----------------------|------------------|--|---------------------------------------|
| | Before operation | During the postoperative hospital stay | Control echo, one month after surgery |
| Without | 145 | 140 | 144 |
| Mild | 0 | 4 | 1 |
| Moderate | 0 | 1 | 0 |
| Severe | 0 | 0 | 0 |

Early complications of coronary artery bypass graft surgery were significantly higher in patients with hypertension than in non-hypertensive patients (P = 0.030).no

significant association was observed between the early complications with age, sex, body mass index, diabetes, MI history, and smoking.

Table 5: Frequency distribution of postoperative complications.

| Complications | Number | Percentage |
|--------------------------------------|--------|------------|
| Atrial Fibrillation | 14 | 9.7 |
| Pleural effusion | 4 | 2.76 |
| Pericardial effusion | 2 | 1.38 |
| Prolonged ventilation | 1 | 0.69 |
| Need for any surgery and readmission | 18 | 12.4 |
| Arrhythmia | 3 | 2.07 |
| Need D/C shock to convert arrhythmia | 1 | 0.69 |
| Incidence of tamponade | 0 | 0 |
| Hospital mortality | 3 | 2.07 |

Discussion

Coronary artery bypass grafting (CABG) surgery is one of the most common and effective methods for treating coronary artery disease (1).

Postoperative bleeding, pericardial effusion and arrhythmia (especially Atrial fibrillation) are among the most common and important postoperative complications (2-7).

Pericardial effusion is a common complication after open heart surgery, so that it is observed in 53-85% of cases (3, 4). The amount of pericardial effusion after surgery is usually low and gradually absorbed. Although pericardium effusion is a common and often benign complication, it can lead to serious and potentially fatal complications such as tamponade and also increases the incidence of atrial fibrillation (5-9).

Atrial fibrillation (AF) is a common complication of cardiac surgery, occurring in 10% to 65% of patients (1).

Atrial fibrillation in about 15-30% of cases is converted to sine rhythm (SR) within two hours and in 25-80% of cases return to the sine rhythm within 24 hours by correcting electrolyte disorders (11).

However, Atrial fibrillation can have unpleasant and even fatal results in the short and long term (12,13). Post-surgery AF may lead to serious complications such as risk of severe kidney damage, hemodynamic instability, heart failure, stroke and death. It also significantly increases the costs of CABG (11, 14, 15).

After surgery, patients are lying on supine position, which can easily cause local

accumulation of fluid in the posterior part of the pericardial cavity.

Normally, after surgery, a drain in the pleural space and a drain is placed under the sternum, and therefore the liquid inside the pericardium space, especially in the posterior part, may not be sufficiently drained by these two drains. On the other hand, implantation of a drain inside the pericardial space is sometimes not possible in cases of coronary bypass because it may cause pressure on the grafts (6, 11, 12). Providing a suitable method for discharge of pericardial cavity after open heart surgery prevents or reduces the above mentioned problems (13). Posterior pericardiotomy is a procedure that reduces the incidence of atrial fibrillation by draining blood and fluids from the posterior part of pericardial cavity. Posterior pericardiotomy (PP) means creating a window from the posterior part of the pericardium space into the left pleural space, which is performed by the surgeon at the end of the operation to reduce the probability of fluid accumulation within the pericardial space and can reduce the incidence of pericardial effusion and its complications. Numerous studies have been performed on the effect of this method in reducing the rate of pericardial effusion and atrial fibrillation after coronary artery bypass grafting.

In the study of Mulay et al., The prevalence of AF in the posterior pericardiotomy group was 20% and in the control group was 26%, which is not a significant reduction, but in the same study, a significant reduction in pericardial effusion was observed (19).

In the study of Zhao et al., The incidence of pericardial tamponade was significantly

lower in the group with pericardiotomy than in the control group. This study concluded that posterior pericardiotomy significantly reduced postoperative tamponade and atrial fibrillation (20).

In a systematic review conducted by Gupta et al. In patients with CABG surgery, a total of 11 randomized clinical trials consisting of 2462 patients were reviewed. Patients who underwent posterior pericardiotomy showed a significant reduction in atrial fibrillation and pericardial effusion.

In a study by Blourian et al, In patients with elective coronary artery bypass graft surgery, posterior pericardiotomy reduced the rate of atrial fibrillation after surgery (21).

In the study of Sadeghpour Tabaei et al., in patients with coronary artery bypass grafting surgery, there was a significant difference in pericardial effusion at the time of discharge. The group with posterior pericardiotomy was 7.4%, and in the group without posterior pericardiotomy was 48.1% (22).

In our study of 145 patients, only 5 (3.36%) patients had pericardial effusion during hospitalization, which was mild in 4 (2.67%) cases and moderate in one case (.69%). Tamponade was not seen in any case and in echocardiography during the first month after surgery there was only one case of mild pericardial effusion.

Atrial fibrillation occurred during hospitalization in 14 patients (9.66%), which in one case was converted by D/C shock and in other cases by antiarrhythmic drugs. Pleural effusion was seen in 4 (2.75%) patients during hospitalization. In the early postoperative period, 3 (2.06%) patients required draining of pleural fluid.

The overall mean drainage of all chest drains from the beginning to the time the drain was removed, was about 795±409 cc.

Therefore, it seems that posterior pericardiotomy significantly reduces the rate of atrial fibrillation, early and late pericardial effusion compared to the usual incidence of these complications.

Limitations: In our study, posterior pericardiotomy was used in all patients and therefore there was no control group.

Conclusion

Posterior pericardiotomy is a simple and safe method of draining posterior pericardial space secretions that may be effective in reducing the incidence of atrial fibrillation, pericardial effusion and pleural effusion after coronary artery bypass grafting.

Limitations

In our study, posterior pericardiotomy was used in all patients and therefore there was no control group.

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Conflicts of interest

The authors have declared no conflict of interest.

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