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FREQUENCY OF PLEURAL EFFUSION IN CABG SURGERY PATIENTS IN WHOM THE INTERNAL THORACIC ARTERY WAS HARVESTED WITH INTACT PLEURA OR WITH PLEUROTOMY

Riffat Tanveer[1], **Asad Khan**[2]

[1,2]Department of Cardiac Surgery, Dow University of Health Sciences, Ojha Hospital, Karachi

Address for Correspondence:

Riffat Tanveer

Department of Cardiac Surgery, Dow University of Health Sciences, Ojha Hospital, Karachi

Emails: riffat_tanveer2003

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Contribution

RT conceived the idea, designed the study. RT, AK did data collection, data analysis, and final drafting of the manuscript. Both authors contributed equally to the submitted manuscript

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ABSTRACT

Objective: To determine the frequency of post-operative pleural effusion in coronary artery bypass graft (CABG) surgery patients who underwent internal thoracic artery(ITA) harvesting in whom pleurotomy was performed and in whom the pleura was intact.

Methodology: A cross-sectional study was carried out from January 2016 to January 2019 at Dow University of Sciences Hospital Karachi. Patients who underwent elective CABG surgery in whom internal thoracic artery (ITA) graft was utilized were included. They were divided in two groups. In one group patients the ITA was harvested with the pleura being intact and in the second group patients pleurotomy was performed. They were assessed for pleural effusion utilizing chest X-ray on the 2nd postoperative day.

Results: From a total of 179 patients in whom the internal thoracic artery (ITA) was harvested, in eighty seveneighty-seven patients the pleura was intact and in ninety twoninety-twopatients pleurotomy was performed. In the intact pleura group seven patients (8.04%) had pleural effusion. In the pleurotomy group a total of twenty five (28.26%) patients had pleural effusion. In CABG surgery patients who underwent ITA harvesting the occurrence of pleural effusion was significantly greater in the pleurotomy group (28.26%) compared to the intact pleura group (8.04%) ($p<0.05$).

Conclusion: In CABG surgery patients who underwent ITA harvesting the occurrence of postoperative pleural effusion was greater in the pleurotomy group compared to the intact pleura group.

Key Words: CABG surgery, Cardiac surgery, Internal thoracic artery, Pleural effusion, Pleurotomy.

INTRODUCTION

For CABG surgery left ITA is the conduit of choice in coronary artery bypass grafting.[1,2] Myocardial revascularization with ITA is the conduit of choice with either utilizing skeletonized or pedicled technique of harvesting.[3,4] ITA utilization for CABG as a choice of conduit is accepted widely due to its high patency compared to vein grafts.[1] But, there is still debate about association of increase postoperative complication occurrence with pleural opening during ITA harvesting.[1,5] Pleural opening (pleurotomy) is suggested during harvesting of ITA.[1] Whether pleural openingduring harvesting should always be done is still a controversial issue. It is seen that with pleural opening there is an increased occurrence of pleural effusion and alsoanincreased risk of thoracentesis.[3,4]

With skeletonized harvesting technique there is significantly lower occurrence of pleural opening.[3,4] Maintaining the integrity of the pleura during harvesting of ITA decreases the occurrence of pleural effusion, due to advantage of reduced rate of pleural effusion it is suggested to keep pleura intact during ITA harvesting.[2,6-9] After coronary artery bypass graft surgery with harvesting of ITA the occurrence of pleural effusion can be reduced with intercostal drainage and it may have protective effect from sudden development of cardiac tamponade if there is severe hemorrhage.[1,8,9]

We conducted this study to determine the frequency in our population of post-operative pleural effusion in CABG surgery patients who underwent ITA harvesting in whom pleurotomy was performed and in whom the pleura was intact.

METHODOLOGY

A cross-sectional study was carried out in Dow University of Health Sciences hospitals from January 2016 to 2019, utilizing the technique of non-probability consecutive sampling. Patients who underwent elective CABG surgery in whom one pedicled internal thoracic artery (ITA) graft was utilized were included in our study. Patients diagnosed with emphysema, asthma, chronic obstructive pulmonary disease were excluded. Moreover, patients diagnosed with pulmonary disease utilizing pulmonary function tests were also excluded. Other patients who were excluded from the study include those with emergency CABG surgery, combined surgeries and ejection fraction less than 45%.

Patients were divided in to two groups. One group consisted of patients in whom ITA was harvested with the pleura being intact and in the second group patients in whom pleurotomy was performed and ITA was harvested. The ITA was harvested utilizing electrocautery and the side branches were closed with hemostatic clips. In all patients intercostal drain was placed.

SPSS 16 was used to analyze the data. The frequencies and percentages were documented for the demographic data of the patients including age, gender, ejection fraction of the left ventricle, diabetes, smoking and hypertension.The operative variables were analyzed. The mean number of coronary arteries bypassed was documented and the mean and standard deviationwere determined for the time period of cardiopulmonary bypass and the time period the aorta was cross clamped.

Postoperative complications were documented. Postoperatively the patients in the study were assessed for pleural effusion utilizing chest X-ray on the 2nd postoperative day. The pleural effusion was classified into mild, moderate and severe. In mild pleural effusion the costophrenic angle was obliterated, in moderate pleural effusion 33% of the lung field was occupied and in severe pleural effusion greater than 33% of the lung field was occupied. The frequencies and percentages of mild, moderate and severe pleural effusions in the intact pleura and pleurotomy groups were noted. The time period of mechanical ventilation required was documented. The frequency and percentage of patients with cardiac tamponade and those requiring re-exploration for cardiac tamponade was recorded. The mean length of ICU and hospital stay was calculated. The Chi square test was applied ($p <$ than 0.05).

RESULTS

From a total of 179 patients in whom the internal thoracic artery (ITA) was harvested, in eighty seven patients the pleura was intact and in ninety two patients pleurotomy was performed. The patients' average age was 61.3 years and 56.9 years in the intact pleura and the pleurotomy groups respectively (Table 1). In the group with intact pleura 73.56% of the patients were male where as in the pleurotomy group 77.17% were male patients. In all the patients the ejection fraction of the left ventricle was greater than 45%. In the intact pleura group 33.33% were smokers, 41.38% were hypertensive, 31.03% were diabetic. In the pleurotomy group 30.43% were smokers, 39.13% were hypertensive, 28.26% were diabetic (Table 1).

The average number of coronary arteries bypassed were 3.2 in the intact pleura group and 03 in the pleurotomy group (Table 2). The cardiopulmonary bypass time was 76.5 ± 4.1 minutes in the intact pleura group and 73.8 ± 3.6 minutes in the pleurotomy group. The time for cross clamping the aorta was 61.3 ± 3.5 minutes in the intact pleura group and 59.2 ± 2.8 minutes in the pleurotomy group (Table 2).

In the intact pleura group a total of seven patients (8.04%) had pleural effusion withall seven patients (8.04%) having mild pleural effusion, while none of the patients had moderate or severe pleural effusion. In the pleurotomy group a total of twenty five (28.26%) patients had pleural effusion, where sixteen patients (18.48%) had mild pleural effusion, nine (9.78%) patients had moderate pleural effusion, while none of the patients had severe pleural effusion. In CABG surgery patients who underwent ITA harvesting the occurrence of pleural effusion was significantly greater in the pleurotomy group (28.26%) compared to the intact pleura group (8.04%) ($p<0.05$).The mean duration of mechanical ventilation was 7.6 hours in the group with intact pleura and 8.5 hours in the pleurotomy group. Cardiac tamponade occurred in 01 (1.15%) patient in the intact pleura group and re-exploration for cardiac tamponade was performed in that patient.

The average stay in the hospital postoperatively was 6.8 days and 7.4 days in the intact pleura group and the pleurotomy group respectively. The mean postoperative intensive care unit (ICU) stay was 2.3 days and 2.7 days in the intact pleura group and the pleurotomy group respectively (Table 3).

Table 1: Demographic Variables of Study Population (n = 179)

Variables	Intact Pleura (Total number: 87) n (%)	Pleurotomy performed (Total Number: 92) n (%)
Age (mean)	61.3 years	56.9 years
Gender	Male = 64 (73.56%), Female 23 (26.44%)	Male: 71 (77.17%), Female: 21 (22.83%)
Ejection fraction > 45%	87 (100%)	92 (100%)
Smokers	29 (33.33)%	28 (30.43%)
Hypertension	36 (41.38%)	36 (39.13%)
Diabetes	27 (31.03%)	26(28.26%)
Body mass index kg/m^2 (Mean ± SD)	27.2±3.1 kg/m^2	25.3±2.7 kg/m^2

Table 2: Operative Variables of Study Population (n = 179)

Variables	Intact Pleura (Total number: 87) n (%)	Pleurotomy performed (Total Number: 92) n (%)
Number of coronary arteries by passed (mean)	3.2	3.0
Time of cardiopulmonary bypass (Mean ± SD)	76.5 ± 4.1 minutes	73.8 ± 3.6 minutes
Time of aortic cross clamp (Mean ± SD)	61.3 ± 3.5 minutes	59.2 ± 2.8 minutes

Table 3: Postoperative Complications of Study Population (n = 179)

Variables	Intact Pleura (Total number: 87) n (%)	Pleurotomy performed (Total Number: 92) n (%)
Pleural effusion (total)	7 (8.04%)	25 (28.26%)
Mild	7 (8.04%)	16 (18.48%)
Moderate	0 (0%)	9 (9.78%)
Severe	0 (0%)	0 (0%)
Mean Duration of ventilation (hours)	7.6 hours	8.5 hours
Cardiac tamponade	1 (1.15%)	0 (0%)
Re-exploration for cardiac tamponade	1 (1.15%)	0 (0%)
Mean Postoperative hospital stay	6.8 days	7.4 days
Mean Postoperative ICU stay	2.3 days	2.7 days

DISCUSSION

In coronary artery bypass grafting ITA is an integral graft material because it has long – lasting patency and is now used in routine.[1,2] ITA utilization for CABG surgery as a choice of conduit is accepted widely due to its high patency compared to vein grafts.[1] Myocardial revascularization with ITA is the conduit of choice either utilizing skeletonized or pedicled technique of harvesting.[3,4] But, there is still debate about association of increased postoperative complication occurrence with pleural opening during ITA harvesting.[1,5]

Whether pleural opening(pleurotomy) during harvesting should always be done is still a controversial issue. It is seen that with pleural opening there is increased occurrence of pleural effusion and also increased risk of thoracentesis.[3,4]

A study showed that the rate of pleural effusion was higher in those patients where the opening of pleura was done, as expected that with opened pleura any mediastinal fluid will move down towards the pleural space to accumulate there. These effusions were mild or moderate and did not develop significant pneumonia or atelectasis.[1] In our study in the intact pleura group a total of

seven patients (8.04%) had pleural effusion with all seven patients (8.04%) having mild pleural effusion, while none of the patients had moderate or severe pleural effusion. In the pleurotomy group a total of twenty five (28.26%) patients had pleural effusion, where sixteen patients (18.48%) had mild pleural effusion, nine (9.78%) patients had moderate pleural effusion, while none of the patients had severe pleural effusion. Patients who underwent ITA harvesting the occurrence of pleural effusion was significantly greater in the pleurotomy group (28.26%) compared to the intact pleura group (8.04%) ($p<0.05$). The average stay in the hospital postoperatively was 6.8 days and 7.4 days in the intact pleura group and the pleurotomy group respectively. The mean postoperative intensive care unit (ICU) stay was 2.3 days and 2.7 days in the intact pleura group and the pleurotomy group respectively.

With skeletonized harvesting technique there is significantly lower occurrence of pleural opening.[3,4] Maintaining integrity of pleura during harvesting of ITA decreases the occurrence of pleural effusion, hence due to the advantage of reduced rate of pleural effusion it is suggested to keep the pleura intact during ITA harvesting.[2] Results of a study documented that there is less incidence of pleural effusion after CABG surgery in those patients with intact pleura.[2,6-9,12-14] Our results correlate with the results of these studies.After coronary artery bypass graft surgery with harvesting of ITA the occurrence of pleural effusion can be reduced with intercostal drainage.8,9If pleural integrity is not maintained then a drain tube is required in the pleural cavity.[3,4]

Pleurotomy and fluid accumulation in pleural cavity has the advantage that in the mediastinal cavity small quantity of fluid can cause cardiac tamponade, while, if pleurotomy is performed then the same quantity of fluid will be tolerated without causing tamponade due to drainage of fluid into the pleural cavity which is of a larger size. So, sudden occurrence of cardiac tamponade can be prevented by opening the pleura and in a comparatively stable condition re-exploration can be performed.1 A study showed that if during harvesting of ITA the pleura is opened, but, it may have protective effect from sudden development of cardiac tamponade if there is severe hemorrhage.[1,2,15] In our study cardiac tamponade occurred in 01 (1.15%) patient in the intact pleura group and re-exploration for cardiac tamponade was performed in that patient.

CONCLUSION

In CABG surgery patients who underwent ITA harvesting the occurrence of postoperative pleural effusion was greater in the pleurotomy group compared to the intact pleura group.

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