

Complication of Pleural Effusion After Open Heart Surgery in Adults at Tertiary Cardiac Care Hospital

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ABSTRACT

Objective: To determine the frequency of early pleural effusion after open heart surgery in a tertiary care cardiac center of Karachi.

Methods: An observational case series was conducted at Cardiac surgical unit, National Institute of Cardiovascular Diseases (NICVD), Karachi from June 2016 to May 2017. Seventy patients who underwent open-heart surgery were reviewed and observe. The age of patient were up to 70 years, with arterial blood gases and pulmonary function tests within normal limits, with a normal X-ray chest, with no other explanation for the pleural effusion. All patient underwent elective open heart surgery (CABG, ASD, VSD, TOF, Valve repair and or replacement) and were observed for Pleural effusion in all those patients in the pleural cavity that become evident on x-ray chest.

Result: Out of 70 patients, 55 (78.57%) were male. Mean age was 53 ± 8.87 years comprising ranged between 47 to 69 years. Mean weight was 67 ± 8.0 kilograms, and mean height was 162 ± 7.32 centimeters. An early Pleural effusion was observed in 08 (11.4%) patients within 30 days of surgery. The incidence of left pleural effusion was found in 6 (8.57%) patients. All patients had moderate effusion, which occupied 25% to 75% of hemithorax.

Conclusion: One of the early complications after open cardiac surgery is pleural effusion, which needs proper management to reduce mortality and morbidity.

Key Word: Open Cardiac surgery, Early Pleural Effusion, Coronary Artery Bypass Grafting(CABG), Tetralogy of Fallot, Valve Repair/ Replacement.

Article Citation: Zakai SB, Khatri AA, Khan NU, Waqar MF, Khaskheli MS. Complication of Pleural Effusion After Open Heart Surgery In Adults at Tertiary Cardiac Care Hospital. J Peoples Uni Med Health Sci. 2017;7(4):146-50.

INTRODUCTION:

Patients undergoing CABG in whom the internal mammary artery (IMA) is used as a graft as compared to saphenous veins have a higher incidence of acquiring pleural effusions^{1,2}. The main reason for this is the performance of leucotomy when the IMA is being harvested. The effusions are predominantly left sided and small and therefore tend to be asymptomatic.

They tend to regress spontaneously and are thus clinically insignificant. Infrequently, the patient may be symptomatic due to a moderate to large effusion.

Pleural effusions can be classified by time intervals: if it occurs within the first week, peri-operative; if within 1 month early; if after 6 months, persistent; and if between 2-12 months, late. Internal mammary artery harvesting(CABG) or diaphragm dysfunction is the primary causes of peri-operative effusions but are often self-limiting. Post-cardiac surgery syndrome results in early effusions and may require treatment especially corticosteroids. Trapped lung syndrome is the primary cause of late/persistent effusions and necessitates decortication³. The incidence of patients developing pleural effusions after open heart surgery particularly CABG, is alarmingly high, at >85%. Fortunately, most of them tend to resolve spontaneously; however, some tend to

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persist, especially those following CABG⁴. When > 25 % of the hemithorax is involved, symptoms develop⁵. Postoperative pulmonary complications are inevitable after any major surgery. However, lungs exposed to the deleterious effects of CPB suffer additional lung injury which further hampers pulmonary recovery when compared with other types of major surgery^{6,7}.

The need to enter the pleural space during mobilization of the IMA⁸ during CABG has been found to be the main reason for these patients having a higher incidence of effusions than those receiving saphenous vein grafts² only. In the majority of patients, they are of little clinical significance, since they are small and regress spontaneously; however, a few patients develop a moderate to large pleural effusion causing significant symptoms. The early postoperative period is when most of the collections are picked up; the incidence has been reported⁹⁻¹¹ to be between 42% to 89%. This disparity has most likely been attributed to the technique used for the diagnosis; higher rates have been reported when ultrasound or computed tomography (CT scan) is used. Literature has reported the incidence of large pleural effusions^{8,10,11} to be 1% to 4%; a small but clinically significant figure. An effusion requiring readmission for treatment, thoracentesis or tube thoracotomy is classified as a symptomatic effusion. The incidence of symptomatic left pleural effusion can be greatly reduced with the use of a supplemental pleural drain that remains in place for several days after surgery¹².

This study was conducted to observe the frequency of early pleural effusions after open heart surgery (CABG, ASD, VSD, TOF, Valve repair and or replacement) in adults, in a Tertiary Cardiac Care Center of Karachi

METHODS:

This observational case-series was conducted at National Institute of Cardio Vascular Diseases, Karachi from June 2016 to May 2017. Seventy adult patients of upto 70 years of age; arterial blood gases, pulmonary function tests and X-ray chest within normal limits who underwent elective open heart surgery (CABG, ASD, VSD, TOF, Valve repair/replacement) were enrolled in the study by non-probability convenience sampling.

X-ray chest was performed in the ICU

within 6 hours in all patients. Another X-ray was repeated at discharge (7-10th postoperative day). They were followed up in the OPD at weekly intervals. Only those patients who developed symptoms had X-ray repeated; otherwise, a final X-ray was done on the 30th post-operative day. Pleural effusions were estimated by the percentage of the hemithorax occupied into three subgroups: less than 25% classified as small; between 25 to 75% as moderate and anything more than 75% as severe.

All relevant data including demographics; medical ailments; list of medicines; echocardiographic-based left ventricular ejection fraction; nature of surgery; details of the effusion; time interval from the surgery to the occurrence of the effusion were documented on a self-administered questionnaire. Data was analyzed statistically.

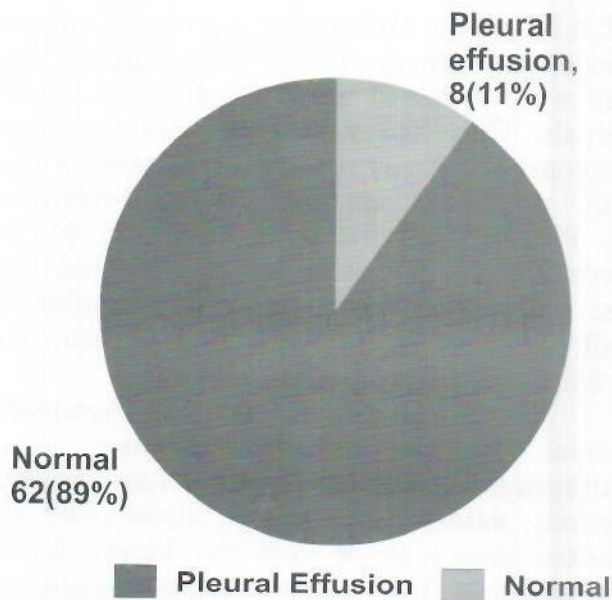
RESULTS:

70 patients who had undergone elective open heart (CABG, ASD, VSD, TOF, Valve repair/replacement) surgery. 55 (78.57%) patients were male. Mean age was 53±8.87 years ranged between 47 to 69 years. Mean weight was 67±8.0 kilograms, and mean height was 162±7.32 centimeters.

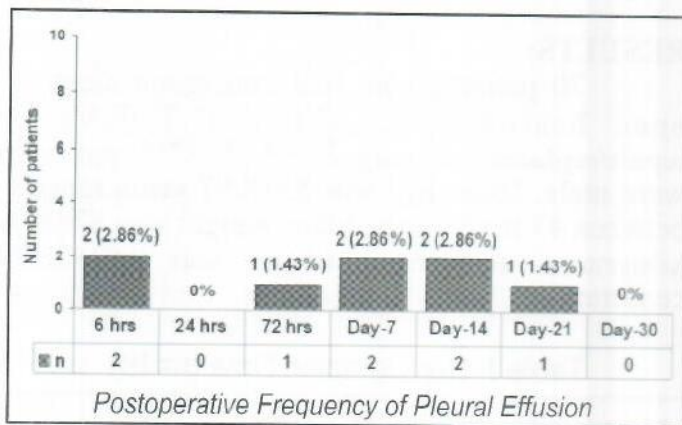
Table I. Demographic Data (n=70)

Demographic Data	Mean±SD	Range
Age (Years)	53±8.87	47-69
Weight (Kg)	67±8.0	52-87
Height (cm)	162±7.32	141-182

An early Pleural effusion was observed in 08 (11.4%) patients within 30 days of surgery (Graph No: I). The incidence of left pleural effusion was found in 6 (8.57%) patients. A right sided effusion was seen in 2 patients (2.8%), No bilateral pleural effusions were observed. All patients had moderate effusion, which occupied 25% to 75% of hemithorax. It was within the first 2 weeks of surgery that most of the early effusions developed 7 (10%) and only one (1.4%) happened in the third week (Graph No: II).



Graph I: Frequency of Pleural Effusion (n=70)



Graph II: Occurrence of Pleural Effusion

DISCUSSION:

Normal individuals have about 2-5ml of fluid in the pleural cavity on each side. Pleural effusion is an excessive accumulation of fluid in the pleural space. It is detected on x-ray chest when 300 ml or more of fluid is present and clinically when 500 ml or more is present. Pulmonary complications in patients undergoing open heart surgery (CABG, ASD, VSD, TOF, Valve repair/replacement) area noteworthy cause for worse outcome¹³.

In the present study, frequency of early effusions (<30 days after open-heart surgery) was 11.4%. The estimated incidence of pleural effusion observed was less than that reported in other studies. The possible reason may be that we diagnosed pleural effusion based on clinical features and plain x-ray chest while in other studies different modalities were used to

diagnose pleural effusion, e.g. CT scan. 02 patients(4%) had pleural effusion in the first 6 hours; while 05 patients (7.1%) developed effusion in the 1st week. Literature highlights a prevalence of pleural effusion of 40% to 75%^{14, 15} in the first week following surgery. About 90% of patients suffer a pleural effusion post CABG within the first week following surgery. Fortunately, the majority is small and self-limiting; however, occasionally, large and persistent collections have also been found. Literature highlights a prevalence of 1 to 4 % of large effusions following open-heart surgery. The majority occurs in the early after surgery; however, a few reach their maximum size many months following surgery. Hulburt⁷ followed 200 patients post-surgery(IMA grafts were used in 100 and saphenous vein grafts in 100); intervention in the form of thoracentesis or tube thoracotomy was required in 4% who had an IMA graft upto the 6th POD. Results were quite similar up-to 2 months in this group; 10.5% had an effusion, one of whom required intervention. In another study conducted by Aarnio P¹⁰ which included 200 patients who had received IMA grafts, it was highlighted that 8.5% required a intervention early after surgery. Although 20% had a collection at 3 months post-surgery, fortunately only 1.5% required thoracentesis. The readmission rate of CABG patients for a pleural effusion was 0.51% in a study conducted by Heidecker J.¹¹

In this study, the incidence of left pleural effusion was 8.57% (06 of 70) which is comparable to a previous study of 9.8% (45 of 460 patients). Right sided collections were a finding in 2 patients. However, no one developed bilateral effusions. The majority of the early effusions occurred within the first 2 weeks of surgery; only one patient had a collection in the 3rd week. The etiology of effusions after open heart surgery is uncertain and the reason for persistence of only some of them remains unknown¹⁷⁻¹⁸. The reported incidence after open-heart surgery¹⁹ is 42% to 66%. They are predominantly small left sided effusions, cause few symptoms and resolve spontaneously within several weeks without any specific therapy. Large effusions develop in about 01% of patients. All of our patients developed moderate effusion. Over the ensuing years, there has been a great dispute whether valve replacement or CABG or a

combination of both are associated with a higher incidence of postoperative pleural effusions. A study in Canada²⁰ highlighted that stronger association of post-operative pleural effusions with valve surgery than CABG. This was contrary to that reported by Light RW²¹ whose study reflected increased percentage of collections in those patients who had undergone either CABG surgery only (63%) or combined CABG and valve surgery (62%) as compared to those who had undergone valve replacement alone (45%). Tetralogy of Fallot (TOF) and univentricular repair are amongst the common causes of prolonged pleural effusion after open heart surgery. Systemic venous hypertension is often reflected by high right atrial pressures following repair of TOF, which increases the mean capillary hydrostatic pressure, leading to excessive fluid buildup in the pleural space. In addition many of these patients may have borderline pulmonary artery and peripheral pulmonary artery stenosis, which leads to elevated right atrial pressures. The presence of residual tricuspid insufficiency, compounds the problem of right heart failure. In patients with TOF and other forms of cyanotic heart disease, an abnormality of the pulmonary vascularity has been observed. Thinning and medial atrophy of the muscular pulmonary arteries has been highlighted; this is associated with dilatation of the pulmonary vasculature, i.e. lumen of arteries, veins, and capillaries. Following surgery which includes opening up of the right ventricular outflow tract obstruction, there is a sudden rise in the intravascular hydrostatic pressure due primarily to increased pulmonary blood flow. This results in an increased gradient across the pleural membranes eventually leading to leading to effusion. In these patients with preoperative polycythemia, there is an acute hemodilution as a result of surgery, resulting in an increased pulmonary blood flow, which leads to effusion. Another contributing factor is prolonged mechanical ventilation; this causes the intrathoracic pressure to rise, and an increase in the systemic venous pressure, ultimately culminating in reduced lymphatic drainage of the pleural cavities, leading to effusion. Low preoperative oxygen saturation is often a reflection of the poor condition of the patient or a severe degree of obstruction to the right ventricular outflow tract, both of which are correlated with a higher incidence of effusion²³.

CONCLUSION:

One of the early complications after open heart surgery is pleural effusion, which needs proper management to reduce morbidity and mortality.

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