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## Effect of Major Lung Resection on Pulmonary Artery Pressure

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### ABSTRACT

**Background:** Major lung resection is one of the surgical procedures which its significant physiologic and hemodynamic effects on the right heart have been recently studied. This study has been implemented to review the effects of this surgery on the most important echocardiographic index of the right heart that is pulmonary artery pressure (PAP).

**Materials and Methods:** 29 patients were consecutively studied during 2 years. Each patient underwent a single transthoracic echocardiography before the operation and another echo study within one week after the operation. Background variables (age and sex) and echocardiographic indices (EF for global left heart function and PAP) were recorded. Analysis of data after review of distribution was done by paired-t-test and Wilcoxon signed rank test.

**Results:** In this study 18 men and 11 women with mean  $\pm$ SD age of  $52\pm 21$  were included. Mean  $\pm$  SD of EF and PAP before the operation were  $57.1\pm 3.9$  and  $26.8\pm 9.9$  respectively. After the operation no significant changes in EF ( $p\geq 1$ ) was observed while PAP changed to  $29.7\pm 11.3$  ( $p<0.086$ )

**Conclusion:** The results showed that reduced pulmonary vascular bed after lobectomy and pneumonectomy did not affect left sided EF, while right sided index (PAP) was slightly elevated although not statistically significant. We can deduce that major lung resection does not affect cardiac outcome and PAP significantly; future studies with more patients and longer follow-ups will clarify this issue. (*Tanaffos* 2004; 3(11): 23-27)

**Key words:** Major lung resection, Pulmonary artery pressure, Echocardiography

### INTRODUCTION

Major lung resection has shown promising results in improving respiratory functional capacity while its effects on right heart hemodynamics have not been established as intensively as respiratory function (1, 2, 3).

Some argue that after pneumonectomy, pulmonary

artery pressure (PAP) is usually normal, but the changes in right ventricle (RV) afterload may be the major cause of RV dysfunction after lobectomy or pneumonectomy (4).

On the other hand, others believe that major lung resection results in stable pulmonary hypertension, which its degree correlates with the duration of postoperative follow-up. They argued that continuous hypertension in pulmonary artery (PA) system was

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responsible for changes on intrapulmonary vessels and lung parenchyma (5, 6).

To demonstrate the exact role of major lung resection in the right heart indices and PA pressure, we designed a study in a tertiary center for thoracic surgery.

## MATERIALS AND METHODS

### Study design and Population

A cross-sectional descriptive study was performed on 30 consecutive patients admitted for lobectomy of at least one lobe or pneumonectomy of one lung during a 2-year period.

All of them filled an informed consent and then thoracotomy was performed for them.

### Echocardiographic studies:

A transthoracic echocardiography was performed before and within one week after the surgery in left lateral or supine position based on the best echocardiographic view (Echo Ving Med CFM 750, GE.). All echocardiograms were obtained by a single cardiologist. In this evaluation, PAP, left and right chambers diameter, tricuspid regurgitation (TR) severity, abnormal septal motion (ASM), ejection fraction (EF), and E/A ratio (for diastolic dysfunction) were assessed.

At the time of echocardiography, all patients showed sinus rhythm and no one suffered from acute MI in the time interval between the two exams that would affect LVEF to some extent.

### Patients care:

Patients received similar and standard anesthetic management and continuous intraoperative monitoring. A thoracic surgeon, a pulmonologist, and a cardiologist observed patients on a regular basis. Indications for surgery were shown in table 1.

**Table 1.** Frequency of surgical indications among study population.

Cause	Frequency (%)
SCC	8 (26.6)
Adenocarcinoma	3 (10)
Carcinoid	6 (20)
Emphysema and bronchiectasis	7 (23.4)
Non- SCC	5 (16.6)
Aspergiloma	1 (3.4)
Total	30 (100)

### Statistical analysis:

Data were analyzed by SPSS software. Paired t-test was also used to assess the data of PAP, Tei index RV and RA sizes, and E/A ratio during pre and post operation period. ASM and TR severity were reported in frequency.

## RESULTS

In this group of 30 patients, 18 were men and 12 were women. Mean  $\pm$  S.D of age was  $52.75 \pm 20.98$  years with the range of 6 to 76 years. The results of echocardiographic variables are shown in tables 2, 3, and 4.

Only one patient was excluded from the study due to inadequate echo window post-operatively.

**Table 2.** Mean  $\pm$  SD of LVD, LVS, RA, RV, Pre and post operatively

Variables	Mean $\pm$ SD	
	Pre- operative	Post- operative
Left ventricle in diastole (cm)	4.47 $\pm$ 0.89	4.39 $\pm$ 1.02
Left ventricle in systole(cm)	3.05 $\pm$ 1.00	3.23 $\pm$ 0.82
LVEF (%)	57.07 $\pm$ 3.90	57.07 $\pm$ 3.90
Right Atrium (cm)	2.84 $\pm$ 0.63	2.87 $\pm$ 0.80
Right ventricle (cm)	2.75 $\pm$ 0.63	2.77 $\pm$ 0.73

**Table 3.** Mean and S.D of PAP, Right tei index and PAT

Variables	Mean $\pm$ SD	
	Pre operative	Post operative
PAP (mmHg)	26.82 $\pm$ 9.94	29.69 $\pm$ 11.28
Right tei index	0.54 $\pm$ 0.18	0.56 $\pm$ 0.21
PAT (msec)	97 $\pm$ 18.96	89.33 $\pm$ 21.16

**Table 4.** Frequency of TR severity in the study population

TR	Frequency (%)	
	Pre operative	Post operative
No	13 (46.7)	9 (33.3)
Trivial	11 (36.6)	15 (50)
Mild	4 (13.3)	5 (16.7)
Moderate	1 (3.4)	
Total	29 (100)	29 (100)

ASM frequency was unchanged during pre and post operation period (6.7%).

## DISCUSSION

Our study demonstrated that major lung resection (either pneumonectomy or lobectomy) had no significant effect on "Right Ventricular Systolic Pressure" (PAP) estimated by the TR jet Doppler velocity method. We could not demonstrate any important increase in RA and RV size from preoperative baseline values in this group.

The early effects of lung resection on the pulmonary circulation have been reported in studies involving small numbers of non-ambulating patients undergoing primary lobectomy (2,5). These authors observed mild elevation in pulmonary vascular resistance and in RV end-diastolic volume and decreased RVEF (2) using pulmonary artery catheters 1 to 3 days after thoracic surgery. On the other hand, Amar et al. did not find a significant difference of RV systolic dysfunction between lobectomy and pneumonectomy patients despite the

increase in right heart pressure seen in the latter group (7).

Comparing to right heart catheterization, echocardiography regarding the non-invasive nature of ultrasound allows real-time assessment of right or left atrial and ventricular sizes as well as function. The obvious limitations of echocardiography are the necessity of technical support, cost, and its limitation as a bedside monitor.

Right heart catheterization may not be desirable in critically ill patients after major pulmonary resection; therefore, postoperative echocardiography combined with central venous pressure monitoring may be a reliable alternative to aid their management (7).

Our data support this current opinion that routine preoperative evaluation of right heart function by invasive method is not justified in patients undergoing major lung resection, but suggest that preoperative echocardiography can be useful to evaluate cardiac function and especially PAP in these patients particularly in view of post operative complications.

## CONCLUSION

This study showed that reduced pulmonary vascular bed after lobectomy and pneumonectomy did not affect left sided EF while right sided index (PAP) were slightly elevated although not statistically significant. We can deduce that major lung resection does not affect cardiac outcome and PAP significantly. To investigate later alterations in right heart function after pneumonectomy, a long term follow-up by echocardiography is warranted.

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