

Post Major Lung Resection Cardiac Arrhythmias

Fawaz A. Khamash MD*, Issa M. Ghanma MD**, Mohammad I. Al-Tarshihi MD*

ABSTRACT

Objective: To describe the possible postoperative cardiac arrhythmias after major lung resection surgery performed for lung malignancies.

Methods: This descriptive study was conducted from January 2007 to October 2009 at the Thoracic Surgery Division of the Royal Medical Services in Amman-Jordan. Forty-eight patients were included in this study. Patients with pre existing cardiac diseases were excluded. All the patients underwent different types of major lung resection surgery for primary and secondary lung malignancies. Postoperative cardiac arrhythmias after different types of lung resection surgery were documented and described. Simple descriptive statistics were used.

Results: The sample included 35 males (72.9%) and 13 females (27.1%). Age ranged between 21 to 82 years (mean 56.6 ± 14.9). Left sided surgery was performed in 21 patients (43.7%), while right sided resections were performed in 27 patients (56.3%). Lobectomy was the most commonly performed operation which was carried out in 27 patients (56.3%), followed by pneumonectomy which was performed in 14 patients (29.2%). Post operative cardiac arrhythmias occurred among 19 patients (39.6%). Atrial fibrillation was the most common reported arrhythmia which occurred in 15 patients (31.2%), followed by supra ventricular tachycardia in 2 patients (4.2%), and 2 patients developed atrial flutter (4.2%). Cardiac arrhythmias were observed to be more common after lobectomy or pneumonectomy, in old male patients, and during the first 48 hours post lung resection.

Conclusion: Post major lung resection cardiac arrhythmias are common. Preoperative evaluation and postoperative cardiac monitoring are mandatory in these patients even among those without pre existing cardiac diseases.

Key words: Arrhythmias, Lung cancer, Lung resection

JRMS March 2011; 18(1): 10-14

Introduction

According to the 2005 World Health Organization report, lung cancer is the leading cause of cancer related deaths in males and the fourth cause of cancer related deaths in females in Jordan.⁽¹⁾ Surgical resection is the best therapeutic option, and provides the best chance of prolonged survival for the early stages nonsmall-cell lung carcinoma.^(2,3) Surgical treatment was defined as a treatment when

the patient had any pulmonary resection for the primary tumor, including pneumonectomy, bilobectomy, lobectomy, segmentectomy, and wedge resection.⁽⁴⁾ Post-lung resection complications, especially pulmonary and cardiac complications, are likely to prolong hospitalization and increase the cost of hospital care, and are associated with an increased risk of mortality.⁽⁵⁾ Arrhythmia, more particularly atrial fibrillation, is

From the Departments of:

*Surgery, Division of Thoracic Surgery, King Hussein Medical Center, Amman, Jordan

**Cardiology, Queen Alia Heart Institute

Correspondence should be addressed to Dr. F. Khamash, P. O. Box 855002 Amman 11855 Jordan, E-mail: fwkhamash@yahoo.com

Manuscript received January 27, 2010. Accepted August 12, 2010

by far the most common cardiac complication after non-cardiac thoracic surgery, with an incidence ranging from 10% to 20% after lobectomy and as much as 40% after pneumonectomy.⁽⁶⁾ In this study, we report the possible postoperative cardiac arrhythmias after major lung resection surgery performed for lung malignancies.

Methods

This descriptive study was conducted during the period from January 2007 through October 2009 at the Thoracic Surgery Division of the Royal Medical Services in Amman-Jordan. Data were retrieved from the Thoracic Surgery Division computerized database and from the medical records. Forty-eight patients were included in this study. All the study patients were diagnosed to have a primary or a secondary lung malignancy. Diagnostic methods included chest X-ray, chest CT-scan, fiberoptic bronchoscopy, bronchial wash cytology, transbronchial biopsy and fine needle aspiration biopsy. Conventional or video-assisted mediastinoscopy were done as needed to rule out N2 lymph node status. For primary lung malignancies, metastatic workup with chest and upper abdomen CT scan that includes the adrenals, brain MRI, and bone isotope scan was done. Positron Emission Tomography scan was done as needed.

The selection criteria to perform metastatectomy for patients with secondary lung tumours were: the primary should be controlled, no extrathoracic metastasis found, and all metastatic nodules could be resected at the same time. Routine preoperative evaluation included a complete history and physical examination, complete blood count with coagulation profile, liver function and kidney function test, pulmonary function test and arterial blood gases. All the patients were sent for cardiac evaluation preoperatively by a specialized cardiologist. Cardiac evaluation included a complete history including risk factors for coronary artery disease, cardio vascular physical examination, electrocardiography, 2-dimensional echocardiography, treadmill test for risk stratification, coronary angio CT scan and cardiac catheterization when needed. Patients with pre existing cardiac diseases were excluded from the study and none of the patients who were included in this study were on preoperative cardiac medications. Pre-operative beta blockers were not used as a prophylactic measure.

The mode of anaesthesia was single lung

ventilation using a double lumen endotracheal tube in all patients. A radial arterial line, subclavian catheter, and a Foley's catheter were inserted in all patients. The patients were positioned in a lateral position according to the site and the preferred incision was a posterolateral thoracotomy. The patients underwent different types of major lung resection surgery for primary and secondary lung cancer which included lobectomy, bilobectomy, pneumonectomy, segmentectomy and wedge resection. All the patients were admitted to the intensive care unit post-operatively. Post-operative Complete Blood Count, electrolytes, kidney function test, arterial blood gases were measured twice daily. Daily chest X-ray was done. Continuous cardiac monitoring included pulse rate, rhythm, blood pressure, central venous pressure, and oxygen saturation. Any postoperative cardiac arrhythmias were documented during Intensive Care Unit stay, and managed by the cardiology team accordingly using anti arrhythmic medications like Adenosine and Isoptin, Amiodarone for atrial fibrillation or flutter and occasionally electrical cardioversion. Simple descriptive statistics were used to analyze the findings. Continuous variables were expressed as means and standard deviations, and categorical variables were expressed as percentages.

Results

The sample included 35 males (72.9%) and 13 females (27.1%). Age ranged from 21 to 82 years (mean 56.6 ± 14.9). Forty-three patients (89.6%) were diagnosed to have primary lung malignancy, while five patients (10.4%) had a secondary lung malignancy. The histopathologies of the diagnosed tumors are shown in Table I. Left sided surgery was performed in 21 patients (43.7%), while right sided resections were carried out in 27 patients (56.3%). Lobectomy was the most commonly performed operation which was done in 27 patients (56.3%), followed by pneumonectomy which was performed in 14 patients (29.2%) as presented in Table II. Post operative cardiac arrhythmias occurred in 19 patients (39.6%). Atrial fibrillation was the most common reported cardiac arrhythmia which occurred in 15 patients (31.2%), 2 patients (4.2%) developed supra ventricular tachycardia and 2 patients (4.2%) developed atrial flutter. Ten patients out of the 14 patients who underwent pneumonectomy developed cardiac arrhythmias

Table I. Histopathology of the resected tumors

Histopathology	Number	%
Squamous cell carcinoma	22	45.8
Adenocarcinoma	12	25.0
Carcinoid	4	8.3
Metastatic sarcoma	3	6.3
Adenosquamous carcinoma	2	4.2
Large cell carcinoma	2	4.2
Undifferentiated sarcoma	1	2.1
Metastatic choriocarcinoma	1	2.1
Metastatic giant cell tumor	1	2.1
Total	48	100

Table II. Types of surgery performed to resect the reported tumors

Type of surgery	Right	Left	Total	%
Segmentectomy	0	1	1	2.1
Upper lobectomy	3	5	8	16.7
Middle lobectomy/lingulectomy	2	0	2	4.2
Lower lobectomy	9	8	17	35.4
Bilobectomy	2	0	2	4.2
Standard pneumonectomy	8	5	13	27.1
Transpericardial pneumonectomy	1	0	1	2.1
Wedge resection	2	2	4	8.3
Total	27	21	48	100

Table III. Reported cardiac arrhythmias in relation to the performed resection type

Procedure	A.F*	S.V.T**	A.FL†	Total	%
Segmentectomy	0	0	0	0	0.0
Upper lobectomy	2	0	0	2	4.2
Middle lobectomy/lingulectomy	0	0	0	0	0.0
Lower lobectomy	4	1	1	6	12.5
Bilobectomy	1	0	0	1	2.1
Standard pneumonectomy	7	1	1	9	18.7
Transpericardial pneumonectomy	1	0	0	1	2.1
Wedge resection	0	0	0	0	0.0
Total	15	2	2	19	39.6

* Atrial Fibrillation, ** Supraventricular Tachycardia, † Atrial Flutter

postoperatively, the most common of which was atrial fibrillation which occurred in eight patients. Table III shows that eight patients out of the 27 patients who underwent lobectomy developed cardiac arrhythmias, the most common of which was atrial fibrillation which occurred in six patients. Arrhythmias occurred in nine patients (18.7%) after right sided surgery and in ten patients (20.8%) after left sided surgery (Table IV). Fifteen males developed arrhythmias (31.2%), while only four females (8.3%) developed arrhythmias (Table V). Table VI demonstrated that twelve patients out of the 19 patients who developed arrhythmias were above 60 years of age. Fourteen patients (29.2%) developed the arrhythmias during the first 24 hours post resection, while five patients (10.4%)

developed the arrhythmias after 24 hours. The average intensive care units stay was 2.82 ± 0.94 days for the patients who did not develop cardiac arrhythmias; while for patients who developed cardiac arrhythmias was 5.00 ± 1.25 days. Four patients (8.3%) died during the postoperative hospital stay; all of them developed cardiac arrhythmias postoperatively.

Eight out of the 15 patients who developed atrial fibrillation reverted spontaneously to normal sinus rhythm within 24 hours, five patients reverted to sinus rhythm using Amiodarone infusion, and two patients needed electrical cardioversion which was successful. All of them were continued on either beta-blockers or calcium channel blockers. Two patients developed atrial flutter. Both of them

Table IV. Arrhythmias in relation to the site of surgery

Procedure	Right	Left	Total	%
Segmentectomy	0	0	0	0.0
Upper lobectomy	0	2	2	4.2
Middle lobectomy /lingulectomy	0	0	0	0.0
Lower lobectomy	4	2	6	12.5
bilobectomy	1	0	1	2.1
Standard pneumonectomy	4	5	9	18.7
Transpericardial pneumonectomy	0	1	1	2.1
Wedge resection	0	0	0	0.0
Total	9	10	19	39.6

Table V. Relation of arrhythmias to gender

Arrhythmia	Male	Female	Total	%
A.F*	11	4	15	31.2
S.V.T**	2	0	2	4.2
A.FL†	2	0	2	4.2
Total	15	4	19	39.6

*Atrial Fibrillation, ** Supraventricular Tachycardia, † Atrial Flutter

Table VI. Relation of arrhythmias to age groups:

Age	A.F*	S.V.T**	A.FL†	Total	%
21-30	1	0	0	1	2.1
31-40	1	0	0	1	2.1
41-50	2	1	0	3	6.2
51-60	2	0	0	2	4.2
61-70	5	1	1	7	14.6
71-80	3	0	0	3	6.2
81-90	1	0	1	2	4.2
Total	15	2	2	19	39.6

*Atrial Fibrillation, ** Supraventricular Tachycardia, † Atrial Flutter

received Amiodarone infusion (300 mg bolus and 1.0 mg/min for 24 hrs) but none reverted to sinus Rhythm. Electrical cardioversion was performed which was successful and they were kept on beta-blockers. Another two patients developed supraventricular tachycardia (SVT) which was reverted to normal sinus rhythm using Adenosine 12mg intravenously.

Discussion

Cardiac arrhythmia after thoracotomy for pulmonary resections is well documented, with atrial fibrillation acknowledged to be the most common occurrence.^(7,8) The aetiology of these complications is still not clearly understood, although several factors are likely to be involved.⁽⁹⁾ Most authors consider increased vagal tone, hypoxemia, hypercapnia, intraoperative fluid imbalance and pericardial handling to be deciding factors. Intraoperative hypotension has also been related to increased risk of arrhythmia.⁽¹⁰⁾

Postoperative arrhythmias after major thoracic operations have been associated with major morbidity and increased perioperative mortality.⁽¹¹⁾ In our study, atrial fibrillation was the most commonly reported cardiac arrhythmia after major lung resection surgery for primary and secondary lung malignancies. This is comparable to the results that were reported by most of the authors.⁽¹⁻¹²⁾

Although, Cardinale *et al.*⁽¹²⁾ reported statistically insignificant rhythm abnormality rates between males and females after major lung resection in our series, rhythm abnormalities were more common in the males after major lung resection surgery. This finding is comparable to the results of Bernard *et al.*⁽¹³⁾ and Roselli *et al.*⁽¹⁴⁾ A possible explanation for this finding is that males constituted the majority sample in our study.

Roselli *et al.*⁽¹⁴⁾ reported that right sided pneumonectomy and older age were statistically significant risk factors to develop atrial fibrillation post lung resection surgery in a series of 604 patients who underwent different kinds of anatomic

lung resection. Similarly, our results indicated that arrhythmias were more common after pneumonectomy and among the older age group, however we did not find any notable difference regarding the incidence of arrhythmias after right sided as opposed to left sided surgery. This difference between our study and Roselli *et al.*'s study may be stemming from our relatively small sample. A larger number is needed to compare the results in a more efficient way.

In our series most of the arrhythmias occurred in the first 24 to 48 hours postoperatively and the incidence declined after that. These results are in agreement with the results of other authors.^(14,15) Regarding intensive care unit stay, patients who developed rhythm abnormalities stayed more as compared with the patients who did not. Some authors suggest the use of pre and postoperative beta-blockers as a preventive measure, although several studies did not show good value for their prophylactic use.^(11,16)

Limitation of the Study

The number of the studied sample is relatively small as compared to other studies. After appropriate literature review, no national studies were found for better comparison. We think that further prospective studies are needed to compare cardiac arrhythmias after minor and major lung resection surgery.

Conclusion

Post major lung resection cardiac arrhythmias are common. Preoperative evaluation and postoperative cardiac monitoring are mandatory even among patients who have no pre-existing cardiac diseases.

References

1. **World Health Organization.** 2005. Preventing chronic diseases: a vital investment: WHO global report. Geneva: WHO.
2. **Duque J, Ramos G, Castrodeza J, et al.** Early Complications in surgical treatment of lung cancer: a prospective, multicenter study. *Ann Thorac Surg* 1997; 63:944–950
3. **Licker M, Widikker I, Robert J, et al.** Operative mortality and respiratory complications after lung resection for cancer: impact of chronic obstructive pulmonary disease and time trends. *Ann Thorac Surg* 2006; 81:1830–1838
4. **Visbal A, Williams B, Nichols III F, et al.** Gender differences in non-small-cell lung cancer survival: an analysis of 4,618 patients diagnosed between 1997 and 2002. *Ann Thorac Surg* 2004; 78:209–215.
5. **Wang J, Olak J, Ultmann R, et al.** Assessment of pulmonary complications after lung resection. *Ann Thorac Surg* 1999; 67:1444–1447.
6. **Decker K, Jorens P, Schil P.** Cardiac complications after noncardiac thoracic surgery: an evidence-based current review. *Ann Thorac Surg* 2003; 75:1340–1348.
7. **Ciriaco P, Mazzone P, Canneto B, et al.** Supraventricular arrhythmia following lung resection for non-small cell lung cancer and its treatment with amiodarone. *Eur J Cardiothorac Surg* 2000; 18: 12-16.
8. **Rena O, Papalia E, Oliaro A, et al.** Supraventricular arrhythmias after resection surgery of the lung. *Eur J Cardiothorac Surg* 2001;20: 688-693
9. **Dyszkiewicz W, Skrzypczak M.** Atrial fibrillation after surgery of the lung: clinical analysis of risk factors. *Eur J Cardiothorac Surg* 1998;13: 625-628
10. **Vaporciyan AA, Correa AM, Rice DC, et al.** Risk factors associated with atrial fibrillation after noncardiac thoracic surgery: analysis of 2588 patients. *J Thorac Cardiovasc Surg* 2004; 127:779-786.
11. **Bayliff C, Massel D, Inculet R, et al.** Propranolol for the prevention of postoperative arrhythmias in general thoracic surgery. *Ann Thorac Surg* 1999; 67:182–186.
12. **Cardinale D, Martinoni A, Cipolla C, et al.** Atrial fibrillation after operation for lung cancer: clinical and prognostic significance. *Ann Thorac Surg* 1999; 68:1827–1831.
13. **Bernard A, Ferrand L, Hagry O, et al.** Identification of prognostic factors determining risk groups for lung resection. *Ann Thorac Surg* 2000;70:1161-1167
14. **Roselli E, Murthy S, Rice T, et al.** Atrial fibrillation complicating lung cancer resection. *J Thorac Cardiovasc Surg* 2005;130:438-444
15. **Neunstein SM, Kahn P, Krellenstein DJ, et al.** Incidence of arrhythmias after thoracic surgery: thoracotomy versus video-assisted thoracoscopy. *J Cardiothorac Vasc Anesth* 1998; 12:659-661.
16. **Mansour Z, Kochetkova E, Santelmo N, et al.** Risk factors for early mortality and morbidity after pneumonectomy: a reappraisal. *Ann Thorac Surg* 2009; 88:1737–1744.