

Analysis of the Results of Pulmonary Resection by Minimally Invasive Thoracoscopy for the Surgical Treatment of Lung Cancer

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ARTICLE INFO

Article type:
Original Article

Article history:
Received: 19 Feb 2018
Revised: 29 Apr 2018
Accepted: 05 Dec 2018

Keywords:
Lung Cancer Surgery
Minimally Invasive
Thoracoscopy
Pulmonary Resection

ABSTRACT

Introduction: Lung cancer is the disease of modern era, and the rate of lung cancer mortality is three times as high as that for prostate cancer and twice as high as the rate for breast cancer. We aimed to analyze the results of pulmonary resection in patients with NSCLC by minimally invasive thoracoscopy.

Material and Methods: We studied 10 patients with NSCLC scheduled for surgical resection by minimally invasive video-assisted thoracoscopic surgery (VATS) in Ghaem Hospital, Mashhad, Iran, during March, 2015-February 2016. The patients were analyzed with respect to age, gender, pathology, surgery type, surgical complications and turning into open surgery, hospital-acquired complications, and mortality rate six months and one year post-operation.

Results: We found that 60% of the patients were male. The patients were within the age range of 47-75 years. The analysis of lesion location showed that most lesions were in the lower lobe of the left lung (50%). None of the VATSs turned into open thoracotomy surgeries. Postoperative complications were observed in 3 (30%) patients. Further, 5 (50%) patients had squamous cell carcinoma (SCC), 4 (40%) of the patients had adenocarcinoma, and 1 (10%) had LCC. The surgical mortality analysis of the patients showed that only one male patient (a 72-year-old patient) died five days after wedge resection due to myocardial infarction. In the six-months and one-year follow up of the nine remaining patients, no cases of death had occurred.

Conclusion: It seems that pulmonary resection by minimally invasive VATS has considerable advantages compared to open surgery, including higher effectiveness, shorter intensive care unit (ICU) stay, higher survival rate, and greater patient satisfaction.

► Please cite this paper as:

Afghani R, Bagheri R, Golhasani Keshtan F. Analysis of the Results of Pulmonary Resection by Minimally Invasive Thoracoscopy for the Surgical Treatment of Lung Cancer. *J Cardiothorac Med.* 2018; 6(2): 282-286.

Introduction

Lung cancer mortality rate is three times higher than that for prostate cancer and almost twice as high as the rate for breast cancer (1). Unfortunately, the 5-year survival rate of this type of cancer is 15% despite the common treatment methods (2). This fact is disconcerting because

lung cancer is one of the most preventable malignancies. Epithelial cancers include small-cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). Immunohistochemistry is useful in differentiating primary adenocarcinoma from metastasis (3).

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The standard treatment for lung cancer includes resection, as well as platinum-based chemotherapy and radiotherapy sometimes along with other methods. Since proved lung cancer provides heterogeneity, proper categorization can be based on sample size and sampling technique, the differential is between SCLC and NSCLC. Surgical removal by a skilled surgeon is the common treatment method in patients with stage I or II clinical NSCLC. Increased survival rate is determined immediately after surgery. The volume of resection depends on physician's judgement and findings of analyses.

A clinical study in patients with stage IA NSCLC showed that lobectomy is a better method than wedge resection with respect to the reduction of recurrence and increase of survival rate in general. Limited removal, wedge resection, and segmentectomy (by video-assisted thoracoscopic surgery [VATS]) may be better for patients with problems such as dyspnea and small peripheral anomalies.

Pneumonectomy is used for patients with central tumors and acceptable respiratory reserve volume. The 5-year survival rate of stage I NSCLC is around 80%, and for stage II, it is about 50%. In some cases, pulmonary resection might be performed using local anesthesia, for example open lung biopsy, but in most cases, it is carried out through administration of anesthesia into the trachea.

Fundamental variation in practice can be found as to the approach to the chest cavity give the customary introduction of VATS or hybrid VATS/ muscle-sparing limited thoracotomy in the surgical armamentarium in order to reduce incision-related morbidity (2). VATS is used for resection, lobectomy, and pneumonectomy (4) and is a substitute method for thoracotomy in many cases of pulmonary resection. The success of laparoscopy in the 80's improved endoscopic video systems, and the development of endoscopic staplers allowed thoracic surgeons to use this technology for the chest cavity (2, 4). Among the advantages of VATS in comparison with other methods is minimizing invasion, decreasing morbidity, mortality, and hospitalization period, as well as expediting recovery. This technique is currently used for pulmonary resection, lobectomy, and pneumonectomy. In comparison with thoracotomy, VATS causes less pain, requires less anesthetics, and is associated with lower adverse effects on the immune system, lower chance of pneumonia, lower chance of vascular fibrillation, lower risk of limitation in shoulder range of motion, shorter hospitalization period, less need for transfer to expert nursing wards, higher chance of completing adjuvant chemotherapy, better pulmonary function after

surgery, and more convenience for senile patients (2). Deformity of the rib cage after surgery is assumed to decrease the adhesion between the thoracic wall and the lungs and help injuries recover more easily. Also, after major removal causes fewer malfunctions. In addition, VATS lobectomy has been reported to have better prognosis in comparison with open thoracotomy (5).

Considering the significance of lung cancer, its mortality rate, and the need for surgery in many cases, choosing the best surgical method for each patient plays an important role in patients' recovery and long-term chance of survival. Since there are multiple advantages to VATS pulmonary resection in comparison with thoracotomy, some of which being higher efficiency, survival chance, and patient satisfaction, we aimed to analyze the results of pulmonary resection through minimally invasive thoracotomy.

Materials and Methods

First, approval was warranted by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran, with the code IR.MUMS.REC.1393.759. In the next step, 10 patients diagnosed with NSCLC and scheduled for pulmonary resection with minimally invasive thoracoscopy From march March, 2015 to February 2016 , including segmentectomy, lobectomy, and pneumonectomy, were included in the study. The patients were analyzed with respect to age, gender, pathology, surgery type, surgical complications, need for open surgery, hospital-acquired complications, and death rate 6 months and 1 year after surgery. Patients with other types of pulmonary tumors, severe adhesions, and other factors that rule out surgery were excluded from the study. Follow-up was performed on the patients 6 months and 1 year post-operation. To analyze the data, the findings were thoroughly collected and entered into SPSS, version 16.

Results

In our study, 10 patients with NSCLC were included, 6 (60%) of whom were men and 4 (40%) women. The patients were within the age range of 47-75 years. The mean age of the patients was 51.20 ± 4.81 years. The mean ages of the male and female patients were 53.83 ± 15.58 and 47.25 ± 5.96 years, respectively. The analysis of lesion location showed that the most frequently involved location was the lower lobe of the left lung (50%), while the least affected location was the lower lobe of right lung (10%), and the upper lobes in both lungs had a 20% share each.

Minimally invasive VATS was performed on the patients. In detail, 70% of the patients (7 individuals) underwent wedge resection, 30% lobectomy, and none of the surgeries turned into open thoracotomy. Regarding length of hospitalization, 20% (2 cases) of the patients stayed in the hospital for more than five days, while 80% (8 patients) had a hospitalization period of less than five days. The length of hospital stay was less than 48 hours in 80% of the patients (8 cases), and only 20% (2 patients) were kept in intensive care unit for more than 48 hours.

The pathologic analysis shows that 50% (5 cases) of the patients were diagnosed with squamous cell carcinoma (SCC), 40% (4 patients)

were diagnosed with adenocarcinoma (ACC), and the remaining 10% (1 patient) were diagnosed with large cell carcinoma (LCC) (Table 1).

Post-surgical complications were analyzed and compared in lobectomy and wedge resection groups as well. These complications in the group undergone wedge resection surgery included one case of air leakage and one case of infection. The analysis of the death rate showed that only one (10%) 75-year-old patient suffered myocardial infarction (MI) and died. None of the patients who had undergone lobectomy died. Also, in the follow up of patients undergone lobectomy, no cases of mortality were reported (Table 2). In the follow up of the nine remaining patients 6 months and 1 year after surgery, no death was reported.

Table 1. Demographic characteristics of the patients

| | | |
|------------------------------------|--------------------------------------|--------------|
| Age, Mean±SD | | 51.20 ± 4.81 |
| Gender | Female | 4(40) |
| N(%) | Male | 6(60) |
| Lesion location | Lower lobe of left lung | 5(50) |
| | Upper lobe of left lung | 2(20) |
| | Upper lobe of right lung | 2(20) |
| | Lower lobe of right lung | 1(10) |
| Surgery type | Wedge Resection | 7(70) |
| | Lobectomy | 3(30) |
| Post-operative complications | Air leakage | 2(20) |
| | Surgical wound infection | 1(10) |
| | No complications | 7(70) |
| Hospitalization period | Less than 5 days | 8(80) |
| | More than 5 days | 2(20) |
| Length of intensive care unit stay | Less than 48 hours | (80) 8 |
| | More than 48 hours | 2(20) |
| Pathology | Diagnosis of squamous cell carcinoma | 5(50) |
| | Diagnosis of adenocarcinoma | 4(40) |
| | Diagnosis of large cell carcinoma | 1(10) |

Table 2. Surgical complications in the two groups N (percent)

| | | Wedge resection group | Lobectomy group |
|--------------------------|--------------------------|-----------------------|-----------------|
| Post-operation infection | Air leakage | 1(10) | 1(10) |
| | Surgical wound infection | 1(10) | 0(0) |
| | No complications | 8(80) | 9(90) |
| Mortality | | 1(10) | 0(0) |
| N (%) | | | |

Discussion

In the patients undergone wedge resection and lobectomy, none of the surgeries turned into open thoracotomy, which increases the efficiency of surgery and survival rate and leads to higher patient satisfaction. In addition, the number of intraoperative complications and the length of ICU stay was less than five days.

Contrary to the expectations, the most common pathology was SCC followed by adenocarcinoma. Surgical mortality was only observed in one male patient five days after surgery due to MI. However, with respect to the evidence as to the use of VATS for geriatric patients further research is needed. No cases of mortality were observed in the patients who underwent lobectomy, as well as the nine

remaining patients in the 6-month and 1-year follow-up period.

Salati et al. in a study performed in 2017 on 195 patients who underwent pulmonary lobectomy ascribed that VATS lobectomy had no advantage over open surgery three months after surgery (6). In our study, all the surgeries were minimally invasive VATS and none turned into open surgery, the complications were minimal and mortality rate was only 10%. However, our study did not include analysis of pulmonary performance pre- and post-operation.

Yang Hao Xian et al. embarked on comparison of long-term survival among robotic surgery, VATS, thoracotomy, and lobectomy for stage I NSCLC. They did not find any independent

relationships between different kinds of surgeries and short-term survival chance in general and survival chance after being cured (7). In our study, all the surgeries were minimally invasive VATS thoracoscopy and none turned into open surgery, and the postoperative complications were minimal.

Based on the surgery results of 85 patients with lung cancer, Ngodngamthaweesuk et al. in 2013 found out that VATS lobectomy can be performed as a minimally invasive surgery that has low morbidity and zero mortality (8). In our study, with respect to low postoperative morbidity rate was desirable.

In 2013, Grallert et al. compared VATS lobectomy for NSCLC patients with other conventional methods and reached to the conclusion that not only VATS lobectomy is a suitable substitute for other common methods, but also it has a higher efficiency and can potentially play a role in stages II and IIIA (9). In our study, all the surgeries were performed through VAST, which yielded positive outcomes and none turned into open surgery. We as well believe that VATS is an efficient and reliable method.

Sukki Cho et al. compared the cost and efficiency of VATS lobectomy with those of open lobectomy for NSCLC in a study in 2011. They discovered that VATS has less side effects, shorter hospitalization period, and lower medical costs relative to open surgery (10). In our study, side effects, complications, as well as hospitalization period after VATS were minimal. Thus, we recommend VAST for NSCLC as a minimally invasive method with lower morbidity and mortality rates in comparison with other methods.

In 2008, Jason et al. analyzed the medical records of 180 patients that had experienced lobectomy or thoracoscopic sublobar resections via VATS, and they concluded that thoracoscopic pulmonary resection can be carried out with confidence on patients aged over 80 years old, patients who have adequate pulmonary function, or those who respond appropriately to neoadjuvant treatment (11). Nonetheless, our study was not able to confirm or reject this notion due to the fact that there were not enough geriatric patients in our statistical population. The overall evidence indicates that VAST can be beneficial for senile patients, although there is a need for further research with larger populations on this issue.

Raja et al. analyzed VAST lobectomy and thoracotomy, as well as robot-assisted surgery for the treatment of lung cancer in 2008, and they discovered that VATS has less side effects and shorter hospitalization period in comparison with lobectomy through thoracotomy. In general, they stated that VAST for lobectomy in stage I NSCLC in

senile patients has less side effects and shorter hospitalization period in comparison with thoracotomy (12). In our study, VAST was not compared with open surgery. However, this study is one of the few studies on the subject of post-surgical complications during hospitalization and follow-up periods. In our study, unlike other similar studies, one patient (10%) died five days post-operation.

Conclusion

With respect to the importance of lung cancer and its high mortality rate, and the fact that many of patients with lung cancer need surgery, choosing a suitable method for surgery plays an important role in recovery and survival rate of these patients. Our study indicated that pulmonary resection with minimally invasive VATS thoracoscopy has multiple advantages in comparison with open surgery. Some of these advantages are increased effectiveness, short length of ICU stay, increased survival rate, and high patient satisfaction. However, this method is questionable when it comes to geriatric patients. We recommend further studies with larger sample sizes addressing senile patients, hospitalization period, and lung performance before and after surgery.

Conflict of Interest

The authors declare no conflict of interest.

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