

The role of VATS in the staging of non small cell lung cancer

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ABSTRACT

Introduction: Since determining of prognosis and treatment method is related to accurate evaluation of TNM staging of non small cell lung cancer (NSCLC), we aimed to evaluate the role of Video-assisted thoracic surgery (VATS) in staging of NSCLC. **Materials and Methods:** This study was performed on 40 patients with NSCLC who had undergone preoperative staging and were candidate for curative surgery between 2008-2010. They underwent VATS immediately before the surgery. After performing VATS, the patients underwent thoracotomy by posterolateral incision unless any criteria of inoperability were present. Diagnostic accuracy of VATS for confirmation or modification of preoperative staging was evaluated. **Results:** M/F ratio was 21/19. Mean age of the patients was 57.2 ± 16.64 yrs. The most common symptom was coughing in 90% of patients. 72.5% of the patients had endobronchial mass and only for 27.5% tissue sample was obtained by transthoracic needle biopsy (TTNB) method. After performing VATS, 6 patients were excluded from surgery (3 cases (7.5%) due to seeding plural metastasis, 2 cases (5%) due to N2 involvement and one case (2.5%) due to satellite lesion in other lobes). Other 34 patients underwent surgery. Surgical resection was performed successfully in 31 cases (77.5%), but in 3 cases (7.5%) due to adhesion to hillum of the lung tumor was not resectable. According to the above results, VATS diagnosing accuracy was 92.5%. **Conclusion:** VATS can help to determine TNM staging and prevent unnecessary thoracotomy in some patients and we recommend this method for accurate staging of NSCLC.

KEY WORDS: Diagnostic accuracy, TNM staging, video-assisted thoracic surgery

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INTRODUCTION

Lung cancer is the main cause of mortality related to cancer in the most developed countries. However, some of the patients at initial stages of disease (stage I, II) are curable.^[1]

One of the most important factors in deciding for treatment of these patients is preoperative staging with the most common form being TNM staging. Since surgical resection is the basic treatment of the patients at stage I, II and is

associated with good results of survival (long-term survival of 50-65%), determining of a preoperative accurate staging method is effective in planning the treatment strategy.^[2]

Although for TNM staging, history, clinical examination, chest CT scan, PET scan, mediastinoscopy, and endobronchial ultrasound are routinely performed; the results are not accurate enough for determining the stage and can be associated with over and under staging.^[3]

Since nowadays multi-modality treatments require accurate staging; more invasive methods in staging have been suggested. Among these methods is VATS which can more accurately evaluate T, N, and M in the patients and can prevent unneeded surgeries.^[4]

The aim of this study was to evaluate the role of VATS in staging of non small cell lung cancer (NSCLC) patients and detection of VATS diagnosis accuracy for accurate evaluation of preoperative surgery.

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MATERIALS AND METHODS

In this prospective study, all the patients with lung cancer type NSCLC referred to Ghaem Hospital of Mashhad University of Medical Sciences were evaluated in terms of preoperative staging (history, clinical examination, chest CT scan, cardiac evaluation, PET, mediastinoscopy, routinely and chest or brain MRI, and Bone scan if needed). All were candidates for surgery. Due to non-availability at our center, EBUS AND EUS were not performed. Before main surgery, the patients immediately underwent VATS surgery with single port and were evaluated in terms of T (tumor extending to mediastinal elements, plural involvement), N (N2 station involvement), and M (satellite lesion that involved other lobe). If the patients had no contraindication for surgery, such as other metastatic plural involvement confirmed by pathology or satellite lesion at involved lobe confirmed by pathology or +N2 station lymph node involvement confirmed by pathology, thoracotomy by posterolateral incision was used. The results of surgery and pathological staging were evaluated. If the patients were not candidates for surgery according to the results of VATS with mentioned criteria, the surgery would be terminated and the patients were referred to oncology department for appropriate treatment.

The data were collected and evaluated in terms of age, sex, type of tumor pathology, method of pathology, results of CT scan, results of VATS (T: Plural involvement or mediastinal elements), N2 involvement, M1 involvement (satellite lesion of involved lobe), results of main thoracotomy surgery, type of pulmonary resection, and VATS diagnosing accuracy.

To evaluate mediastinal extension in VATS, the patients were divided into three groups based on the results of preoperative CT scan, and VATS.

1. Patients with confirmatory CT scan finding
2. Patients without confirmatory CT scan finding
3. Impossible to confirm CT scan finding.

Data were statistically analyzed by SPSS software version 11.5 and to evaluate VATS diagnosing accuracy, we also used distribution, mean, and standard deviation for quantitative variables and frequency for qualitative variables. Diagnostic accuracy was estimated by table of test validity, for calculating diagnostic accuracy we divided the summation of true positive and true negative by the number of total cases.

Technique

Mediastinoscopy was performed with standard technique in the patients at supine position under general anaesthesia by a small incision in supra sternal notch. Sampling was classically performed for all patients from (2L, 2R, 4L, 4R, 7) areas, and were sent for pathology evaluation.

VATS was also performed immediately before main surgery by double lumen ventilation and evaluation

was performed by single port VATS (in terms of plural involvement, tumoral adhesion satellite lesion, N2 station LN involvement); in case of any doubt, sampling was performed and were sent for frozen section and decision was made based on the results of pathology. If there was no contra-indication for main surgery, final surgery was performed by standard posterolateral thoracotomy incision and open technique.

RESULTS

A total of 40 patients entered the study with ratio of M/F = 21/19. Mean age of the patients was 57.2 ± 16.64 yrs (min 15 and max 65 yrs). The most common symptom was acute coughing in 36 patients (90%). Other symptoms were hemoptysis in 27 patients (67.5%) and exertion dyspnea in 33 cases (82.5%) and pleuritic chest pain in 17 cases (42.5%).

In the preoperative evaluation, important findings in CT scan with IV contrast were as follows:

Observation of mass lesion in 40 patients (100%), observation of hilar or mediastinal lymphadenopathy in 17 cases (42.5%), and observation of effusion in 9 cases (22.5%) which cytology of pleural liquid and pleural biopsy were negative in all of these 9 patients. There was the possibility of involvement of mediastinal elements (direct extension) (22.5%).

Flexible bronchoscopy and BAL were performed for all patients before surgery and 29 patients (72.5%) had endobronchial mass and biopsy was performed for them. For 11 cases (27.5%) because of peripherally located lesions and no endobronchial mass, tissue samples were taken by the method of TTNB under the guide of CT scan. For all patients, accurate diagnosis of preoperative pathology was performed.

All the patients underwent standard mediastinoscopy with samples from (2L, 2R, 4L, 4R, 7) areas and the results of pathology were negative in all.

The patients who were candidates for main surgery underwent VATS immediately before final surgery and the results of VATS immediately before final surgery were unresectable tumors in 6 patients (3 cases (7.5%) due to seeding plural metastasis confirmed by pathology, 2 cases (5%) due to N2 station (one case in station 4 and one case in station 9), and one case (2.5%) due to satellite mass that involved other lobe). The remainder 34 patients (85%) underwent thoracotomy immediately after VATS and surgical resection was performed successfully in 31 cases (77.5%), but in 3 cases (7.5%) due to adhesion of tumor to hilum, tumor was not resectable. Table 1 shows type of surgical resection and the frequency of pulmonary resection in 31 patients underwent surgery. Table 2 shows the frequency of pathological results. In terms of diagnosing accuracy of VATS for evaluation of tumor direct extension based on the results of CT

Table 1: Frequency and type of pulmonary resection

Technique of surgery		Frequency	Percent
Lobectomy	Right	13	41.9
	Left	9	29
Bilobectomy	Right	4	13
Pneumonectomy	Right	2	6.5
	Left	3	9.6
Total		31	100

Table 2: Frequency and type of pathological result

Pathology	Frequency	Percent
Adenocarcinoma	16	40
Bronchoalveolar carcinoma	7	17.5
Larg cell carcinoma	6	15
Squamous cell carcinoma	6	15
Sarcoma	2	5
Infiltrative carcinoma	1	2.5
Adenosquamous carcinoma	1	2.5
Basaloid carcinoma	1	2.5
Total	40	100

scan, in 9 patients (22.5%) there was report by CT scan that involvement of hillum of the lung and mediastin elements; VATS showed that in 5 cases (12.5%), tumor was resectable (not confirmed by CT scan finding), and in 4 cases (10%), we couldn't determine whether tumor was resectable or not (impossible to confirm CT scan finding).

Based on the final results of surgery, all the patients in the group of non confirmatory CT scan findings) (5 cases = 12.5%) had successful pulmonary resection. In 4 cases (10%) which we couldn't determine whether tumor was resectable or not (impossible to confirm CT scan finding), tumor was resectable in 1 case (2.5%) and not resectable in 3 cases (7.5%).

According to the above results, VATS diagnosing accuracy for accurate evaluation of preoperative surgery was 92.5%.

DISCUSSION

Performing TNM staging in lung cancer type NSCLC is important for deciding the patients' treatment and prognosis.^[4]

One of the criteria for determining preoperative staging is T and M stage which can be evaluated by bronchoscopy, CT scan, MRI, and needle biopsy. Nevertheless, some of the patients which are considered to be at stage IIIB can be in lower stages and the patients which are estimated to be at stage I and stage II can be at higher stage and more accurate evaluation is needed.^[4]

The study of Passlick and co-workers reported that VATS was a suitable method in evaluation of pleural involvement, finding lymph node (N2), or pulmonary (N1) metastases on the other side. They even reported that in patients with effusion and negative cytology, VATS can confirm plural spreading in 60% of cases and recommended performing

VATS before thoracotomy for prevention of un-needed thoracotomies.^[4]

The main problem in treatment planning of these patients is evaluation of N stage, since an important factor for treatment planning and survival estimation is N2 or 3 stations involvement.

De Langen, *et al.* performed a study in 2006 about evaluation of N staging. They attempted to answer the question of whether lymph node size observed in CT scan is a criterion for performing complementary methods to obtain tissue samples. They showed that it is better for all of these patients to undergo FDG-PET after CT scan and divided the patients into three groups: group I: 10-15 mm, group II: 16-20 mm, group III: >20 mm. They found that the patients with tumor size: 10-15 mm with negative PET (the possibility of lymph metastasis is < 5%) were not candidates for other methods for obtaining tissue samples; other patients with either positive or negative PET scans were candidates for mediastinoscopy.^[5] Another study by Billé, *et al.* in 2009 showed that lymph node size and the results of negative PET were not accurate for evaluation of the patients in terms of N2 stage involvement and they recommended routinely performing of mediastinoscopy for all patients.^[6]

Standard mediastinoscopy is a gold standard method and is confirmed by the most researchers for all patients with lung cancer, and tissue sampling should be performed in 5 areas: (2L, 2R, 4L, 4R, 7); for increasing the diagnosing accuracy of mediastinoscopy, other methods are mentioned.^[6,7]

Block and colleagues in 2010 reported that performing endobronchial ultrasound is a complementary method in N staging and declared that biopsy of all stations is performable by EBU and it is better to perform two biopsies of each station to increase diagnosing accuracy.^[8] In study performed by Gomez *et al.* using EBUS with needle biopsy is considered helpful to diagnose central lymphadenopathy.^[9]

Kuzdzał, *et al.* in 2007 mentioned that performing transcervical extended mediastinal lymphadenectomy is a suitable method in mediastinoscopy for N evaluation. The results of this method were similar to mediastinoscopy and the rate of invasion was also similar to mediastinoscopy.^[10] Of course, these studies were limited and the more studies are required.^[11]

To increase diagnosing accuracy, VATS is usually combined with mediastinoscopy to cover the areas which mediastinoscopy cannot observe.^[6]

Since VATS can perform sampling of lymph nodes in these areas, it is a good replacement for extended mediastinoscopy.^[4] Of course, standard mediastinoscopy has sensitivity of 81% and specificity of 91% and cannot evaluate some patients.^[12]

A study performed by Witte, *et al.* on combination of

mediastinoscopy with VATS to increase diagnosing accuracy showed that this combination was helpful to increase diagnosing accuracy of standard mediastinoscopy.^[13]

Among accurate diagnosing methods in N2 station is dye injection in tumor and evaluation of sentinel lymph nodes by VATS. In the study of Yamashita, *et al.* in 2011, they could find sentinel lymph nodes by injection of indocyanine green fluorescence image guide surgery and recommended to dissect the lymph node if they were not involved; diagnosing accuracy of this method was 80.7%.^[14]

CONCLUSION

Since treatment planning and prognosis determination require accurate evaluation of TNM staging, it seems that preoperative VATS can help to determine TNM staging and prevents unnecessary thoracotomy in some patients and we recommend this method. However, the numbers of the patients in our study are limited and a definite conclusion needs further studies.

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