CHARACTERISTICS OF LYMPH NODE METASTASIS IN PATIENTS WITH NON-SMALL CELL LUNG CANCER UNDERGOING LOBECTOMY AND SYSTEMIC LYMPH NODE DISSECTION AT HANOI ONCOLOGY HOSPITAL

Phan Le Thang, Pham Dac Dong*, Nguyen Van An, Pham Van Hoan

ABSTRACT

Objective: To evaluate characteristics of lymph node metastasis in patients with non-small cell lung cancer who underwent surgery.

Methods: Retrospective study on patients with stage I-IIIA non-small cell lung cancer who underwent lobectomy and lymph node dissection at Hanoi Oncology Hospital from September 2023 to September 2025.

Results: There were 144 patients enrolled in the study. The incidence of lung cancer increased with age, with a mean age of 57 ± 11.08 (35-79). The male/female ratio was nearly equal. Right-sided lung tumors were more common than left-sided tumors; most of these tumors were ≤3 cm with spiculated margins. The majority of patients were in stages I and II, accounting for 96.5%. Thoracoscopic surgery was performed in 95.8% of patients. The average number of lymph nodes dissected per patient was 11.32 ± 4.58. The rate of lymph node metastasis was 33.6%, in which N1 metastasis accounted for 27.6% and N2 metastasis for 6%. Lymph node metastasis was positively correlated with lymph node size and primary tumor size; the difference was statistically significant ($p<0.05$). There was no statistically significant difference in the rate of lymph node metastasis according to factors such as primary tumor location, pleural invasion, and histopathological type.

Conclusion: Lymph node metastasis in non-small cell lung cancer accounted for 33.6%, including N1 metastasis in 27.6% and N2 metastasis in 6%. The likelihood of lymph node metastasis increased in proportion to lymph node size and primary tumor size. There was no difference in the rate of lymph node metastasis according to factors such as primary tumor location, pleural invasion, and histopathological type.

Keywords: NSCLC, lobectomy, lymph node dissection, lymph node metastasis.

Hanoi Oncology Hospital

*Corresponding author: Pham Dac Dong
Email: phamdacdong@gmail.com

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1. INTRODUCTION

Lung cancer is one of the most common cancers globally and in Vietnam. According to GLOBOCAN 2022, lung cancer ranked third in incidence with 24,426 new cases and second in cancer-related mortality with 22,597 deaths in Vietnam [1].

In clinical practice, lung cancer is divided into two main groups: small cell lung cancer, which accounts for about 15%, and non-small cell lung cancer (NSCLC), which accounts for about 85%. Surgery remains the main treatment modality and is especially important for stage I-IIIA NSCLC. To achieve radical resection, in addition to lobectomy, regional lymph node dissection according to the nodal map is required to remove all lesions [2].

The pulmonary lymph node system is divided into 14 groups. Regional lymph node dissection serves both a curative purpose and provides specimens for histopathological diagnosis to accurately determine metastasis in each nodal group, thereby enabling correct staging and prognosis. This is a major operation; therefore, identifying which nodal groups are commonly metastatic is extremely important in order to remove all involved lymph nodes, and reduce the risk of recurrence, improve survival, and avoid unnecessary extensive lymph node dissection that may be dangerous and may cause complications. Studies have shown that lymph node metastasis occurs in 20-40% of patients with non-small cell lung cancer and is associated with certain factors such as the location, size, and invasive characteristics of the primary tumor [3]. However, there have been relatively few studies on this topic in Vietnam. Therefore, we conducted this study in order to evaluate the characteristics of lymph node metastasis in patients with non-small cell lung cancer who underwent lobectomy and systemic lymph node dissection.

2. STUDY SUBJECTS AND METHODS

2.1. Study subjects

The study subjects included 144 patients with stage I, II, and IIIA non-small cell lung cancer who underwent surgical treatment at Hanoi Oncology Hospital from September 2023 to September 2025 according to the following criteria.

2.1.1 Inclusion criteria

- Patients diagnosed with lung cancer at stage I, II, or IIIA (according to IASLC), based on histopathology from needle biopsy or frozen section, who underwent lobectomy and N1/N2 lymph node dissection.

- Postoperative histopathology confirmed non-small cell lung cancer.

- Patients were fit for general anesthesia, lobectomy, and lymph node dissection (general condition, cardiovascular status, and respiratory function).

2.1.2 Exclusion criteria

- Patients who had received neoadjuvant chemoradiotherapy, because assessment of tumor and lymph node size would no longer be accurate, or those with another concomitant cancer.

- Patients who had undergone surgery before the study period and later developed local recurrence requiring reoperation.

- The disease was assessed as beyond the surgical stage (IIIB, IV) during surgery.

2.2. Data collection process

- Step 1: Select patients according to the study criteria.

- Step 2: Collect clinical and paraclinical information and determine disease stage.

- Step 3: Collect/extract data regarding surgical

characteristics and postoperative outcomes from medical records, surgery (thoracoscopic: 138 cases; open surgery: 6 cases).

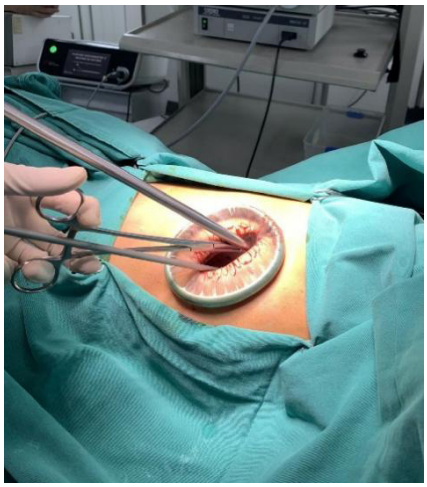

Figure 1: Thoracic incision in single-port thoracoscopic surgery

Surgical procedure: Double-lumen endotracheal anesthesia was used to collapse the affected lung. A 4-5 cm skin incision was made through the 4-5th or 5-6th intercostal space depending on the patient. A soft wound protector was used. Alternatively, conventional thoracotomy was performed. The artery, vein, and bronchus were dissected and divided using a stapler; the lung lobe was removed in a specimen bag; and lymph node dissection was performed using an ultrasonic scalpel or LigaSure, a minimum of one N1 and three N2 stations sampled. Hemostasis was secured, a chest drain was placed, and the operation was completed. Specimens were sent for examination and postoperative follow-up was performed.

2.3. Study methods

The study was conducted using a retrospective descriptive design. Data were collected using a standardized study record form and analyzed with SPSS 20.0 software. Differences were considered statistically significant if $p \leq 0.05$.

3. RESULTS

3.1. General characteristics of the study patients

Table 1. Gender distribution by age group

Age	Gender (n=144)	
	Male (n=71; 49.3%)	Female (n=73; 50.7%)
≤ 40	0 (0%)	1 (0.7%)
40-60	31(21.5%)	35 (24.3%)
≥ 60	40 (27.8%)	37 (25.7%)
Total	71 (49.3%)	73 (50.7%)

Totally 144 patients were enrolled in the study with 49.3% patients were males and 50.7% were females

According to the above table 1, mean age was 57 ± 11.08 (35-79). The rate of lung cancer increased with age. The male/female ratio was nearly equal.

Table 2. Tumor location and size on computed tomography and preoperative staging

Tumor location	Number of patients		Percentage %		
Right lung					
Upper lobe	34		23.6		
Middle lobe	13		9.0		
Lower lobe	41		28.5		
Left lung					
Upper lobe	21		14.6		
Lower lobe	35		24.3		
Tumor size	Mean: 3.1 ± 1.91 (1.1-6.1)				
Tumor size ≤ 3 cm	86		59.7		
3 < tumor size ≤ 5 cm	53		36.8		
5 < tumor size ≤ 7 cm	5		3,5		
Stage	IA	IB	IIA	IIB	IIIA
Patients (n)	20	55	39	25	5
Rate (%)	13.9	38.2	27.1	17.3	3.5

The above Table 2 showed that right-sided lung tumors were more common than left-sided tumors, mainly in the lower lobes on both sides. Most tumors were smaller than 3 cm. Most patients were in early stages I and II; stage IIIA accounted for only 3.5%.

3.2. Surgical characteristics and lymph node metastasis

3.2.1. General surgical characteristics

Table 3. General surgical characteristics

Characteristics	Number of patients	Percentage
Surgical method		
Thoracoscopic surgery	138	95.8
Open surgery	6	4.2
Frozen section		
Yes	14	9.7
No	130	90.3
Surgical complications		
No	141	97.9
Pulmonary artery injury	3	2.1

According to the Table 3 above, most patients underwent thoracoscopic surgery (95.8%) and had preoperative histopathology (90.3%). In terms of surgical complications there were 3 cases of pulmonary artery injury during lymph node dissection.

3.2.2. Characteristics of lymph node metastasis

Table 4. Dissected regional lymph nodes

Lymph node size	N1 nodes (n %)	N2 nodes (n %)	Overall (n%)
≤ 10 mm	623 (54.4)	310 (63.9)	933 (57.2)
10-15 mm	420 (36.7)	130 (26.8)	550 (33.7)
15-20 mm	87 (7.6)	42 (8.7)	129 (8.0)
> 20 mm	15 (1.3)	3 (0.6)	18 (1.1)
Total	1.145 (100)	485 (100)	1.630 (100)

According to the Table 4 above, the average number of lymph nodes dissected per patient was 11.32±4.58. The fewest nodes dissected in one patient was 3 and the highest was 27; the smallest lymph node measured 4 mm and the largest 28 mm in diameter.

Table 5. Rate of metastasis by regional lymph node groups

	N1 nodes (n %)	N2 nodes (n %)	Overall (n%)
Positive nodes	450 (39.3)	97 (20)	547 (33.6)
Negative nodes	695 (60.7)	388 (80)	1.083 (66.4)
Total	1.145 (100)	485 (100)	1.630 (100)

The above Table 5 showed that the lymph node metastasis rate was 33.6%. Among positive nodes, metastasis occurred mainly in N1 nodes, accounting for 70.2% of all metastatic nodes.

Table 6. Relationship between lymph node size and metastatic potential

Lymph node size	Overall N1 N2		Total	p
	Positive	Negative		
≤ 10 mm	186 (19.9%)	747 (80.1%)	933 (100%)	0,01
10-15 mm	261 (47.4%)	289 (52.5%)	550 (100%)	
15-20 mm	82 (63.6%)	47 (36.4%)	129 (100%)	
> 20 mm	18 (100%)	0 (0%)	18 (100%)	
Total	547	1083		

According to the above Table 6, the larger the lymph node is, the higher the likelihood of metastasis is. Among nodes ≤10 mm, only 19.9% were positive; this rate increased progressively, reaching 100% in nodes >20 mm.

Table 7. Relationship between primary tumor size and lymph node metastasis

Tumor size	No lymph node metastasis	N1 lymph node metastasis	N2 lymph node metastasis	Total (%)	p
≤ 3 cm	52 (60.5)	21(24.4)	13 (15.1)	86 (100)	0,018
3-5 cm	21 (39.6)	31 (58.5)	1 (1.2)	53(100)	
5-7 cm	1 (20)	2 (40)	2 (40)	5 (100)	

Table 7 above showed that the rate of lymph node metastasis increased in proportion with the tumor size; the difference was statistically significant (p = 0.018).

Table 8. Relationship between pleural invasion and lymph node metastasis

Pleural invasion	No lymph node metastasis	N1 lymph node metastasis	N2 lymph node metastasis	p
Yes	27 (36.5%)	29 (53.7%)	9 (56.3%)	0.534
No	47 (63.5%)	25 (46.3%)	7 (43.7%)	
Total	74 (100%)	54 (100%)	16 (100%)	

According to the above Table 8, there was no relationship between the appearance of pleural invasion and lymph node metastasis.

Table 9. Relationship between tumor location and lymph node metastasis

Tumor location	No lymph node metastasis	N1 lymph node metastasis	N2 lymph node metastasis	p
Right upper lobe	24 (16.7%)	8 (5.6%)	2 (1.4%)	0.195
Right middle lobe	7 (4.9%)	5 (3.5%)	1 (0.7%)	
Right lower lobe	25 (17.4%)	11 (7.6%)	5 (3.5%)	
Left upper lobe	11 (7.6%)	6 (4.1%)	4 (2.8%)	
Left lower lobe	7 (4.8%)	24 (16.6%)	4 (2.8%)	

Table 9 above showed that lymph node metastasis was not related to tumor location; metastasis was commonly observed in the right upper lobe and both lower lobes.

Table 10. Relationship between histopathology and lymph node metastasis

Histopathology	No lymph node metastasis	N1 + N2 lymph node metastasis	Total	p
Adenocarcinoma	65 (53.7%)	56 (46.3%)	121 (100%)	0,205
Squamous cell carcinoma	9 (39.2%)	14 (60.8%)	23 (100%)	
Other types	0	0	0	

According to the above Table 10, lymph node metastasis did not depend on the histopathological characteristics of the tumor.

4. DISCUSSION

4.1. Characteristics of lymph node metastasis

Most patients in our study group did not have lymph node metastasis; only 33.6% had nodal metastasis, most of which was N1 metastasis, accounting for 70.2%. This result is consistent with previous studies. For example,in the study by Le Hai Son et al., the rate of lymph node metastasis was 38.1%, and isolated N1 or N2 station metastasis accounted for a high proportion [4]. Studies have shown that lymph node metastasis in non-small cell lung cancer occurs in 20-40% of patients and is associated with characteristics such as the location, size, invasive nature of the primary tumor, and the anthropological characteristics of the study population [3,4].

4.2. Relationship between lymph node metastasis and selected tumor characteristics

In this study, we found that the rate of lymph node metastasis was associated with lymph node size and primary tumor size. However, there was no statistically significant relationship between the rate of lymph node metastasis and factors such as age, sex of the study group, tumor location, histopathological characteristics, or occurring of pleural invasion.

In many studies, most authors have reported that lymph node metastasis is related to tumor size. According to a study at Military Central Hospital 108, the rate of lymph node metastasis was 59.3% for tumors <5 cm and 66.7% for tumors >5 cm and <7 cm; the metastatic pattern was related to the size of the primary tumor [4]. Studies by JinLong Zhao et al. [5] and Pham Cam Phuong et al. [6] also showed a correlation between tumor size and the risk of lymph node metastasis in lung cancer: the larger the primary tumor is, the higher the rate of lymph node metastasis is.

In our study, the rate of lymph node metastasis increased in proportion to lymph node size: among nodes ≤10 mm, only 19.9% were positive, and this rate rose progressively to 100% in the group of nodes >20 mm. Studies in Vietnam and worldwide have consistently shown that lymph node size is directly proportional to the likelihood of metastasis, especially in nodes >20 mm, in which the metastasis rate is nearly 100%. According to Tadasu Kohno (2012) (n=160), the rate of lymph node metastasis was 15% in nodes ≤10 mm, 61.2% in nodes 11-20 mm, and 94% in nodes >20 mm [7]. Mai Trong Khoa's study (2013) in 33 patients reported rates of 8.2% for nodes ≤10 mm, 61.6% for nodes 11-20 mm, and 100% for nodes >20 mm [8].

The study by Le Hai Son [4] showed that N1 lymph node metastasis was common in tumors located in the right upper lobe or left lower lobe; superior N2 lymph node metastasis was commonly seen in right upper lobe tumors,

aortopulmonary region nodes in left upper lobe tumors, and subcarinal nodes in tumors located in both lower lobes. However, our study and some others did not find a relationship between tumor location and the likelihood of lymph node metastasis [6]. These differences among studies may be due to differences in sampling method, sample size, and variation in surgeons' indications for surgery. Therefore, the relationship between age, tumor size, and tumor location and the risk of lymph node metastasis should be further studied systematically with larger sample sizes and standardized surgical indications.

5. CONCLUSION

Lymph node metastasis in non-small cell lung cancer accounted for 33.6%, with N1 metastasis being the most common in 27.6% and N2 metastasis in 6%. The likelihood of lymph node metastasis increased in proportion to lymph node size and primary tumor size, and the difference was statistically significant ($p<0.05$). There was no difference in the rate of lymph node metastasis according to factors such as primary tumor location, pleural invasion, and histopathological type. This research provides us with a preliminary insight into the prognosis of lymph node metastasis in patients with non-small cell lung cancer.

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