Journal of the Egyptian Nat. Cancer Inst., Vol. 13, No. 2, June: 117-128, 2001

Non-Small Cell Lung Cancer: Evaluation of a Two-Year Experience of Surgical Treatment for Lung Cancer in the National Cancer Institute

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ABSTRACT

Lung cancer is the most common cancer in the world contributing 13% of total cancer cases in both sexes, ranking first in males and third in females. The aim of this study is to evaluate the results of surgical treatment for this type of tumor in the surgical department of the National Cancer Institute, Cairo University between Jan. 1995 and Dec. 1998. This study included fifty patients with non-small cell lung cancer (NSCLC). The mean age for the patients was 54 years and the male to female ratio was 3:1. All male patients were cigarette smokers with a mean of 23 cig/day and the mean duration of symptoms was four months. The right lung was more commonly affected by the disease (60%). The average tumor size was 6 cm in its greatest dimension. Forty-six percent of the cases had presented in stage 1B. Most of the cases were of the adenocarcinoma type (38%), while the squamous cell type was detected in 16 cases (32%). Clinically, stage I cases represented only 46% of the cases. Twenty-four cases were subjected to total pneumonectomy (48%), right penumonectomy (16 cases) and left pneumonectomy (8 cases). Lobectomy was carried out in 26 cases (52%), one lobe resection in 24 cases while bilobectomy was performed in 2 cases. Associated chest wall resection was done in 6 cases (12%) and partial pericardiectomy was done in other 6 cases (12%). The vagus nerve was sacrificed in one case and vertebral transverse processes were resected in 2 cases. Cardio-vascular and respiratory post-operative complications were detected in 17 cases (34%), while surgery related complications were found in 6 cases (12%). Twenty-one patients underwent surgery alone, while 13 patients received adjuvant chemotherapy, 8 patients received adjuvant radiotherapy and 4 patients received combined chemo- and radiotherapy. Fourteen patients developed metastases on follow up at a mean time of 8.5 months. The overall actuarial 2-year survival data showed that 44% of the patients were alive free of disease, while 4% were alive with the disease and 34% of the patients died due to cancer related causes. Nine patients (18%) were lost for follow- up.

Key Words: *Non-small cell lung cancer (NSCLC) - Adenocarcinoma - Pneumonectomy - Lobectomy - Survival.*

INTRODUCTION

Lung cancer is considered the most common cause of death due to malignancy all over the world. It accounts for 13% of total cancer cases in both sexes ranking first in males and third in females, with male to female ratio 3:1 **[8,14]**. About 80% of newly diagnosed lung cancer is non-small cell lung cancer (NSCLC), 30-35% of the cases present in earlier stages (stage I & II), while another 30-35% present with locally advanced disease (stage III). The remaining 40% of the cases are metastatic disease at the time of diagnosis **[31]**. Early detection of lung cancer, preferably before onset of symptoms, is prognostically very important. It was found that the five-year survival rate is 25% among lung cancer patients with symptoms, compared to 65% for the asymptomatic group detected by screening **[19]**. Tobacco has been blamed as an etiologic carcinogen in 80-90% of all lung cancer cases, while occupational exposure causes about 15% of lung cancer in men and 5% in women. The increasing incidence of lung cancer in females is related to the increased number of young female smokers. Male predominance is becoming 2:1 **[14,54,55,57,59]**. Most lung cancers are epithelial tumors, sarcomas and lymphomas are very rare. Lung cancer is divided into two main categories; small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC) (20% and 80% respectively). The leading pathological type of NSCLC is the adenocarcinoma type; commonly occurring at the lung periphery. The next common pathological type is the squamous cell type, which usually arises in the sub segmental or larger bron-

chi as a fungating endo-bronchial mass in 90% of cases. Other less common types may occur as large cell carcinoma (15%), adeno-squamous type (0.4-4%) and neuro-endocrinal tumors, as carcinoid tumors, in 5% of cases. Other rare tumors of the lung may include blastomas, carcino-sarcomas intra-vascular broncho-alveolar tumors, lymphomas, malignant melanomas, sarcomas (osteo-, chondro- and soft tissue sarcomas) and Ewing's sarcoma. Fifty to eighty percent of these rare tumors are asymptomatic **[3,11,20,27,28,32,41,42,43]**.

Surgery is still regarded the most effective method in controlling the primary tumor provided a complete resection is possible and the risks of the procedure are low. Occult lung cancer, stage I and stage II tumors are effectively treated with surgical resection in the form of pneumonectomy, lobectomy, segmentectomy, or sleeve resection; all procedures are associated with mediastinal node dissection according to the location of the tumor and pulmonary functions **[6,18,21,24,33,36,38]**. Staging for lung cancer has been modified by Ginsberg in 1997 **[22]** (Fig. 11) to include patients with T3 tumors of any size with direct extension to the chest wall, diaphragm, mediastinal pleura, pericardium (without involving the heart, great vessels, trachea, or esophagus), or vertebral bodies, or tumors in the main bronchus within 2 cm from the carina. These tumors are included with stage IIb guided that there is no epsilateral mediastinal nodal involvement and no distant metastasis (T3 N0 M0). These cases are successfully treated with surgical procedures. Chest wall resection, with or without reconstruction of the chest wall, in selected T3 cases (stage IIb) is associated with overall survival of 56% at one year, 40.9%-56% at two years, 13.5%-38% at three years and 10% to 37% at five years **[1,2,4,39,40,46,47]**. In T3 cases with involvement of the mediastinum and the diaphragm, complete surgical resection is associated with a 5-year survival of 30% if there was no mediastinal nodal involvement **[37]**. The survival of patients with N2 disease varies from zero to 40% according to the extent of nodal involvement, T status and the ability to perform complete resection. Some articles in the literatures reported that the 5-year survival in patients with microscopic mediastinal nodal disease may reach up to 41%. Administration of adjuvant chemotherapy to patients with N2 disease significantly increased the survival **[49,52,56]**.

Chemotherapy alone or radiotherapy alone have a limited role in the cure of NSCLC. Radiation therapy as a postoperative adjuvant therapy will improve local control in stage II and III, but its impact on survival is controversial **[25, 29,48]**. Radiation therapy is not indicated in stage I disease if completely resected and less favorable results are obtained with radiation therapy for the treatment of incompletely resected, recurrent, or irresectable diseases **[10,30, 47,50,51]**. The addition of postoperative chemotherapy has better impact on the treatment results for lung cancer over the use of radiation therapy. In completely resected stages II and III adenocarcinoma or large cell carcinoma; the addition of cyclophosphamide (400 mg/m^2), doxorubicin (40 mg/m^2) and cis-platinum (40 mg/m^2) (CAP) every 4 weeks for six cycles will lower the recurrence rate and will increase the disease free interval and the overall survival **[16,26]**. Many chemotherapy regimens were used as preoperative neoadjuvant chemotherapy had shown improvement in the resection rate with consequent improvement in the median survivals for stage IIIa and IIIb NSCLC **[7,13,15, 17,35,52,53]**.

PATIENTS AND METHODS

This study included 50 cases, which were admitted to the National Cancer Institute, Cairo University. All of them were operated upon between Jan. 1995 and Dec. 1998 for pathologically proven NSCLC; either through bronchoscopic or CT guided biopsy. All patients were investigated by chest X-ray, thoraco-abdominal CT with contrast (Figs. 1-5), fibro-optic bronchoscopic examination, spirometeric pulmonary functions, ECG and full laboratory investigations. Echocardiography, bone scan and brain CT were performed when indicated. TNM system published by The International Union Against Cancer (UICC) was used for classification and staging of our patients **[24,58]**.

Standard procedures included lung resection (either pneumonectomy or lobectomy) and hilar and mediastinal nodal dissection or sampling. Extended procedures were performed when the tumor invaded removable neighboring anatomic structures e.g., chest wall resection or partial pericardiectomy. Postoperative pain control was achieved through thoracic epidural analgesia, intra-pleural catheter analgesia, or intravenous morphia.

Postoperative morbidity and mortality within 30 days post-operatively were evaluated. All pathologically proven lymph node positive cases were referred for postoperative chemotherapy, while locally advanced resected tumors (T3,T4) cases were referred for postoperative radiotherapy.

Patients were followed up every 2 months in the first year and then after at three-month interval. Re-evaluation was carried out by clinical examination, chest X-ray and abdominal ultrasonographic examination. Thoraco-abdominal CT, bone scan and brain CT scan were performed when indicated. The actuarial survival at the end of 2 years was estimated with correlation to different prognostic factors: stage of the disease, nodal status, pathologic type and grade, type of resection, safety margin, duration of symptoms and gender.

Statistical analysis:

Statistical Package for Social Science (SPSS) was used for data analysis. Mean and standard deviation described quantitative data and propitious described qualitative data. Chi-square and Fisher exact tests were used for comparing proportions. Kaplan Meier procedure was used for estimating survival and log-ranks test for comparing survival curves. *p* value less than 0.05 was considered significant.

RESULTS

Fifty patients with lung cancer (NSCLC) had presented to the surgical department of the National Cancer Institute, Cairo University. The mean age of presentation was 54 years with the range of 23-75 years. Out of the 50 cases, males accounted for 37 cases, while females presented 13 cases. Male to female ratio was 3:1. All male patients were cigarette smokers with a mean number of 23 cig/day. Most of the patients (66%) were urban dwellers, while 34% of them lived in rural areas. All patients (100%) presented with cough and expectoration, with or without other symptoms such as dyspnea (68%), haemoptysis (42%), chest pain (18%) and hoarseness of voice (2%) (Table 1). The mean duration of symptoms was 4 months. The right lung was more commonly affected by the disease (60%), while the left lung was affected in 40% of the cases. The right upper lobe was the most common site affected by the disease (22%) (Table 2). The mean tumor size detected by CT and by pathology examination measured 6 cm, ranging from 3 cm to 12 cm. Tumors > 5 cm were found in 54% of the cases. A difference between CT and pathological staging was found with CT specificity 82.9%, sensitivity 66.7% and total accuracy 80%. Out of 13 cases with radiologically positive mediastinal or hilar lymph nodes, only 6 had pathologically proven nodal metastasis. Of the nine cases with pathologically positive nodal deposits, only six were diagnosed preoperatively, by CT, to have nodal deposits (Table 3). The commonest pathological type was the adenocarcinoma in 19 cases (38%), while squamous cell type represented only 16% of cases (8 cases). Less common pathological types presented in 14% of cases (7 patients). Out of these seven cases, three had carcinoid tumor (6%), another three had bronchoalveolar carcinoma (6%) and one case (2%) had NHL (Table 4). Most of the patients presented in stage IB (46%), while 28% of the patients presented in stage IIB, 22% presented in stage IIIA and only 4% of them presented in stage IIIB. Postoperative pathological classification showed noticeable changes in staging especially in stage IIB, where the incidence increased to 38% of the patients. Also, the incidence of patients in stage IIIA showed slight drop in 18% of the cases (Table 5).

All the patients were subjected to surgical treatment including resection of the tumor with hilar and mediastinal nodal dissection. Sampling of mediastinal lymph nodes, with frozen section examination, was performed in 7 cases, where the lymph nodes were obviously negative at exploration. Total pneumonectomy was carried out for 24 patients (48%), right pneumonectomy (Figs. 6,10) in 16 cases (32%) and left pneumonectomy in 8 patients (16%). Different types of lobectomy were performed in 26 patients (52%). Right upper (Figs. 7-9), lower and middle lobectomy were performed in 6 cases (12%), 4 cases (8%) and 2 cases (4%), respectively. Bilobectomy had been performed in 2 cases (4%). Left upper and lower lobectomies were performed in 6 cases (12%) for each. Fifteen patients had additional procedures with lung resection (30%). Of these 15 patients, 6 patients had chest wall resection (12%), 6 patients had partial pericardiectomy (12%), 2 patients had resection of transverse processes (4%) and one patient had the vagus nerve sacrificed (2%) (Table 6). Postoperative pain control

was achieved by intra-pleural analgesia through the insertion of an intra-pleural catheter in 30 cases (60%), by thoracic epidural analgesia in 15 cases (30%) and by intravenous morphia in 3 cases (6%) with satisfactory results except in 2 cases. Postoperative complications developed in 17 cases (34%). Fourteen cases (28%) had respiratory complications in the form of lung collapse and atelectasis. Cardiac complications, in the form of arrhythmias and supra ventricular tachycardia, developed in 12 cases (24%). Operative related complications, in the form of empyema, wound sepsis, or air leakage, developed in 6 patients (12%). A combination of complications occurred in a single patient. Four patients died during the inter-operative period with surgery related morality 8%. Two cases died from severe intra-operative hemorrhage and 2 cases died from adult respiratory distress syndrome (ARDS) and respiratory failure in the early postoperative period (Table 7).

During follow up of patients for two years, metastatic deposits were detected in 14 patients (28%). Metastasis was detected in three of 22 patients with stage I disease (13.5%); one case had bone deposits, while two patients had contralateral lung deposits.

Seven cases from 17 with stage II disease developed metastatic deposits (41%); 3 cases had contralateral lung deposits, 2 cases had bone metastasis and two cases had developed brain deposits. Four cases from 9 with stage IIIA disease had developed metastatic deposits (44%); 2 cases had bone deposits, one case developed brain metastasis and one case had both brain and soft tissue metastases (Table 8).

The overall actuarial 2 year survival data showed that 22 patients (44%) were alive and free of disease. Of these 22 patients, 14 cases were stage IB, 5 cases were stage IIB, 2 cases were stage IIIA and one case was stage IIIB. At the end of 2 years of follow up two cases were alive with the disease; one case with contra lateral lung deposits and one case with bone metastasis. Seventeen cases (34%) died from cancer related causes during follow up. These 17 cases included the 4 cases who died in the early perioperative period, 3 cases were stage IB, 7 cases were stage IIB, 2 cases were stage IIIA and one case was stage IIIB. Nine cases were lost for follow up (Table 9). By stage, the overall actuarial 2 years survivals were 76%, 14.6% and 10.3% for stages IB, IIB and III, respectively (Table 10).

Univariate analysis was used to evaluate survival in relation to different factors and their prognostic impact on survival. Tumor size (5 cm) was found significant (p=0.03). (Fig. 12). The pathological type significantly affected the survival. The best estimated survival was for NHL and the worst survival was estimated for undifferentiated tumors (p=0.02) (Fig. 13). Node negative cases had a near statistically significant better survival than node positive cases (p=0.06) (Fig. 14). The best estimated survival was for patients with stage IB and the worst was for stage III ($p < 0.001$) (Fig. 15). Lobectomy had statistically better survival over pneumonectomy (p=0.005) (Fig. 16). Patients with duration of symptoms less than 4 months were found to have statistically significant better survival than those who had symptoms more than 4 months before treatment (p=0.02) (Fig. 17).

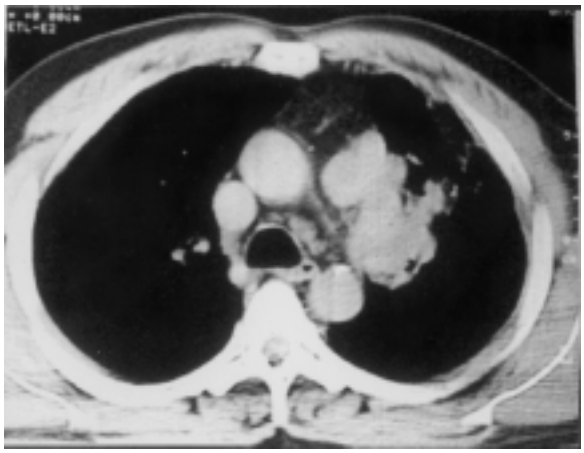

Fig. (1): CT scan chest; central bronchogenic carcinoma with mediastinal lymph node enlargement.

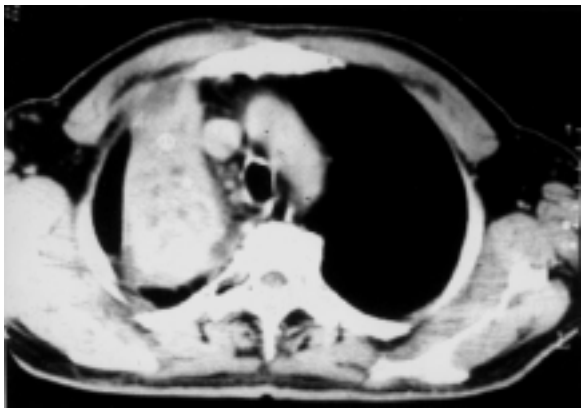

Fig. (2): CT scan chest; huge central bronchogenic carcinoma.

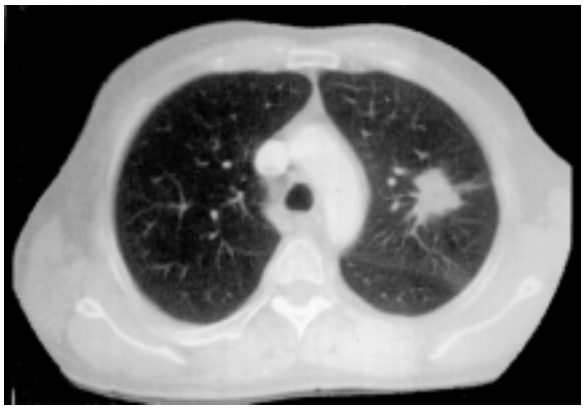

Fig. (3): CT scan chest; peripheral lung cancer.

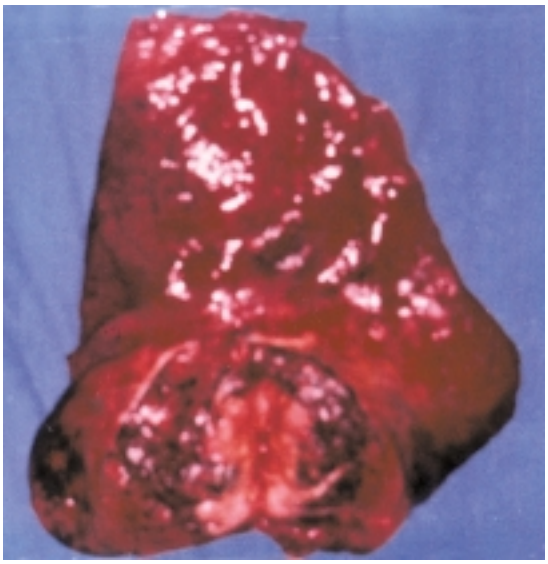

Fig. (6): Surgical specimen; right pneumonectomy for a huge right lower lobe bronchogenic carcinoma.

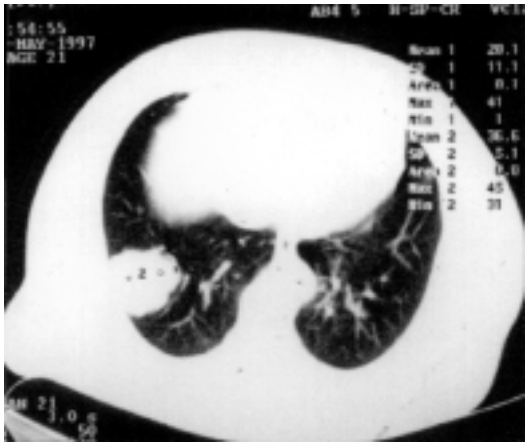

Fig. (4): CT scan chest; peripheral bronchogenic carcinoma.

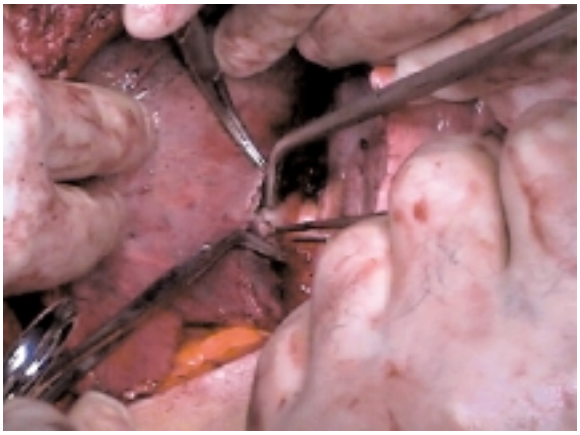

Fig. (7): Right upper lobectomy; exposure of the right pulmonary artery within the oblique fissure.

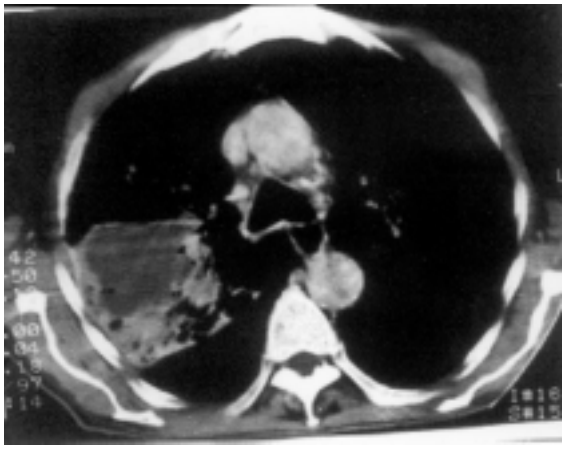

Fig. (5): CT scan chest; peripheral bronchogenic carcinoma with central necrosis and chest wall invasion.

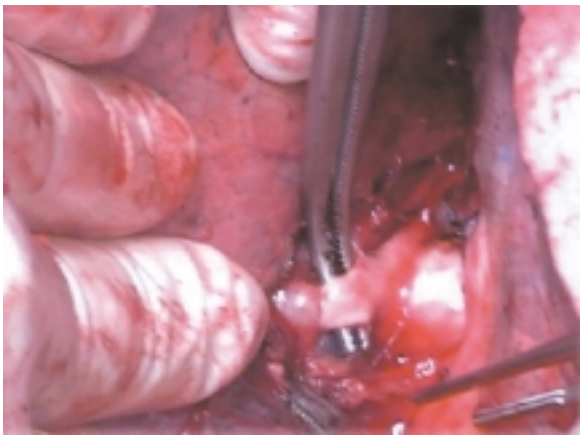

Fig. (8): Right upper lobectomy; dissection of the posterior segmental artery.

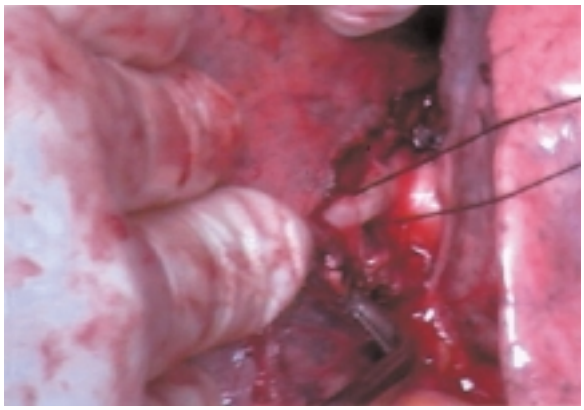

Fig. (9): Right upper lobectomy; ligation of the posterior segmental artery.

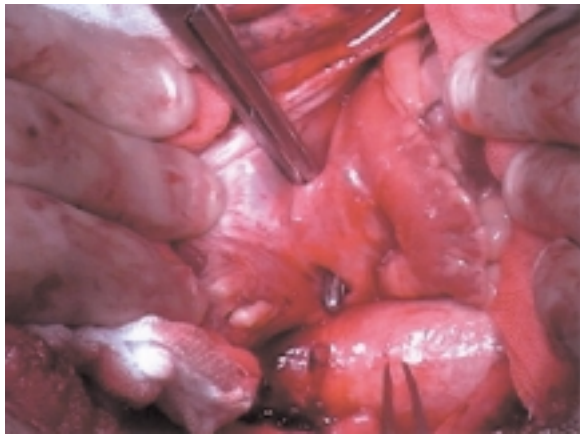

Fig. (10): Right pneumonectomy; intra-pericardial dissection and ligation of the right pulmonary vein.

TNM classification for lung cancer; The American Joint Committee for Cancer (AJCC).

Stage 0	Tx	N0	M0
	Tis	N0	M0
Stage I	T1	N0	M0
	T2	N0	M0
Stage II	T1	N1	M0
	T2	N1	M0
Stage IIIA	T3	N0	M0
	T3	N1	M0
	T1-3	N2	M0
Stage IIIB	Any T	N3	M0
	T4	Any N	M0
Stage IV	Any T	Any N	M1

Recent modification by Ginsberg et al. **[22]**.

- Stage I is further subdivided inot

Stage IA	T1	N0	M0
Stage IB	T2	N0	M0

- Stage II is further subdivided into A,B and T3N0M0 is included in stage IIB.

Stage IIA	T1	N1	M0
Stage IIB	T2	N1	M0
	T3	N0	M0

As there is prognostic and survival difference between T1 and T2

Fig. (11): Staging of lung cancer.

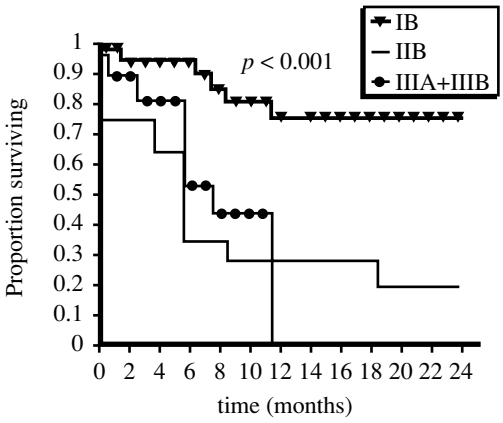

Fig. (12): Overall survival of 50 cases with lung cancer primarily treated with pulmonary resection by pathological stage.

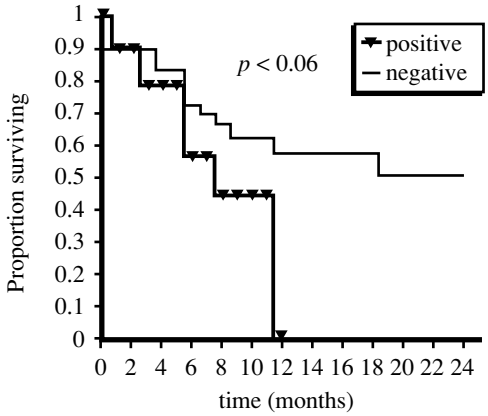

Fig. (13): Overall survival of 50 cases with lung cancer primarily treated with pulmonary resection classified by lymph node status by pathological examination.

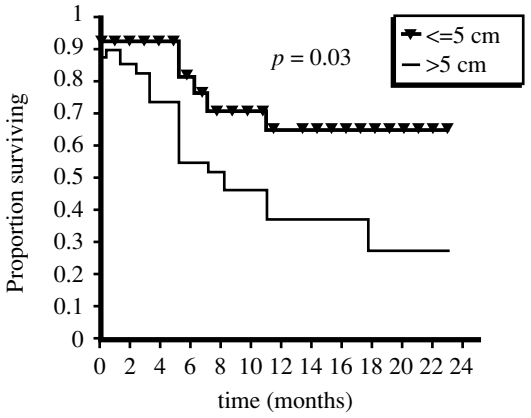

Fig. (14): Overall survival of 50 cases with lung cancer primarily treated with pulmonary resection classified by tumor size.

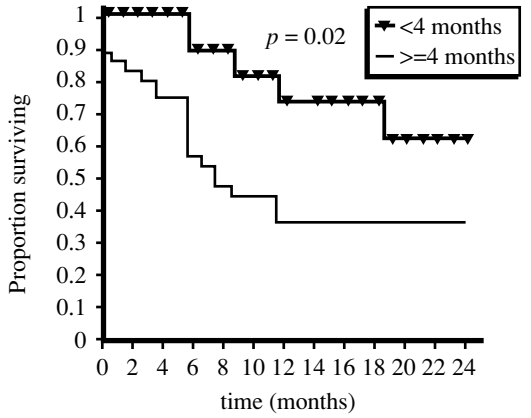

Fig. (15): Overall survival of 50 cases with lung cancer primarily treated with pulmonary resection according to duration of symptoms.

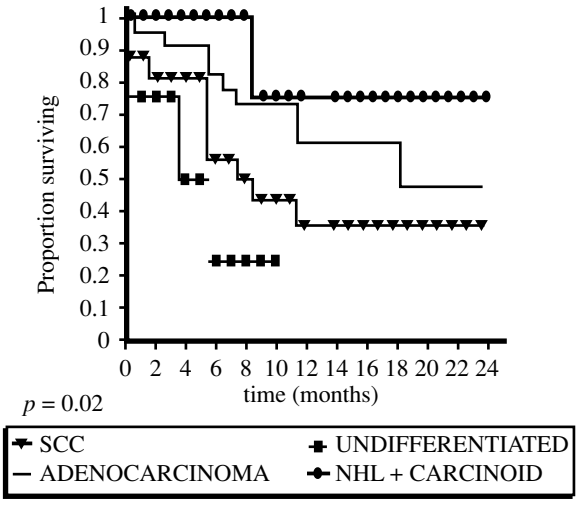

Fig. (16): Overall survival of 50 cases with lung cancer primarily treated with pulmonary resection classified by pathological subtype.

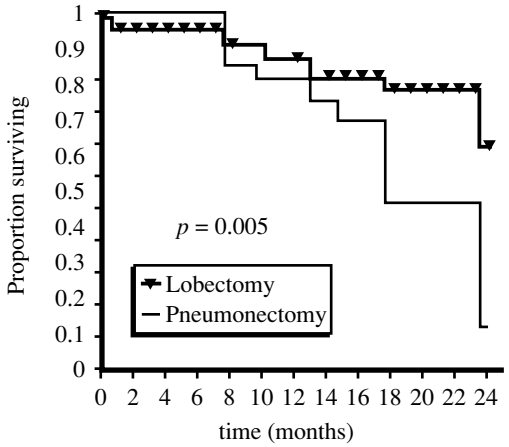

Fig. (17): Overall survival of 50 cases with lung cancer primarily treated with pulmonary resection classified by resection type.

Table (1): Presenting symptoms in 50 cases with NSCLC.

Symptoms	No. of patients	%
Cough & expectoration	50	100
Dyspnea	34	68
Haemoptysis	21	42
Chest pain	9	18
Hoarseness of voice	1	2

Table (2): Anatomical distribution of 50 lung cancer tumors as shown by chest X-ray and CT scanning.

Tumor site	Chest X-ray		CT scan	
	No.	%	No.	%
Right upper lobe	11	22	11	22
Right middle lobe	2	4	3	6
Right lower lobe	7	14	7	14
Left upper lobe	9	18	9	18
Left lower lobe	8	16	7	14
Right central	10	20	9	18
left central	3	6	4	8
Total	50	100	50	100

Table (3): Lymph node status by CT and postoperatively in 50 cases with NSCLC.

Lymph node status	CT		Pathological	
	No.	%	No.	%
Positive lymph nodes	13	26	9	18
Negative lymph nodes	37	74	29	58
Not examined	-	-	12	24
Total	50	100	50	100

Table (4): Distribution of pathological types among 50 cases with NSCLC.

Pathological types	No.	%
Adenocarcinoma	19	38
Squamous cell carcinoma	16	32
Undifferentiated (large cell type)	8	16
Carcinoid	3	6
Bronchoalveolar	3	6
NHL	1	2
Total	50	100

Table (5): TNM staging for 50 cases with NSCLC.

	Clinical		Pathological	
	No.	%	No.	%
IB	23	46	22	44
IIB	14	28	17	34
IIIA	11	22	9	18
IIIB	2	4	2	4
Total	50	100	50	100

Table (6): Operative procedures in 50 cases with NSCLC.

Procedure	No.	%
Lobectomy:	26	52
Right upper lobectomy	6	12
Right middle lobectomy	2	4
Right lower lobectomy	4	8
Bilobectomy	2	4
Left upper lobectomy	6	12
Left lower lobectomy	6	12
Pneumonectomy:	24	48
Right pneumonectomy	16	32
Left pneumonectomy	8	16
Additional procedures:	15	30
Chest wall resection	6	12
Partial pericardiectomy	6	12
Vertebral TV process resection	2	4
Vagus nerve resection	1	2
Total	50	100

Table (7): Postoperative morbidity and mortality following lung resection in 50 cases with NSCLC.

	No.	%
Postoperative morbidity:	17	36
Respiratory	14	28
Cardiovascular	12	24
Surgery related	6	12
Postoperative mortality:	4	8
Intra-operative hemorrhage	2	4
Adult respiratory distress syndrome	2	4

Table (8): The incidence of metastatic deposits in two years by stage in 50 cases with NSCLC treated with surgery.

Site of metastasis	Stage IB No. (%)	Stage IIB No. (%)	Stage IIIA No. (%)
Bone deposits	2/22 (9%)	2/17 (12%)	2/9 (22%)
Brain deposits	0/22 (0%)	2/17 (12%)	2/9 (22%)
Contralateral lung deposits	1/22 (4.5%)	3/17 (17%)	0/9 (0%)
Total	3/22 (13.5%)	7/17 (41%)	4/9 (44%)

Table (9): End results of treatment of 50 cases with lung cancer at the end of 2 years of follow up.

	No.	%
Alive free of disease	22	44
Alive with disease	2	4
Died	17	34
Lost follow-up	9	18
Total	50	100

Table (10): Two-year actuarial survival for 50 cases with lung cancer primarily treated by pulmonary resection.

Survival (in month)	Stage I (%)	Stage II (%)	Stage III (%)
6	95.5	35.4	54.6
12	76.7	29.4	21.4
18	76.7	29.4	10.3
24	76.7	14.6	10.3

DISCUSSION

Non-Small Cell Lung Cancer (NSCLC) is considered the commonest type of cancer all over the world, ranking first in males and third in females. Male to female ratio is 3:1. In recent several series the ratio of 1.6:1 was recorded **[5,14]**. In our study, the ratio was 3:1, this may be due to the fact that we still have a lower incidence of smoking among young females. The mean age recorded was 61:65 years **[52]**, while in our study it was found to be 54 years; ranging from 23 to 75 years. The earlier age of presentation in our study may be attributed to the earlier age of starting smoking, environmental pollution and bad occupational environment. All male patients in our study were smokers and only one of 13 females had a history of smoking. This may explain the low incidence of bronchogenic carcinoma in females in our study. Air pollution and environmental status explains that the higher number of our patients were among urban dwellers (66%).

All our patients presented with cough and expectoration (100%) as the main presenting symptom. All of the male patients were smokers and complaining from smoking related cough a long time before seeking medical advice, which may explain the late presentation of our patients. The mean duration of symptoms in our study was 4 months, ranging form 2-8 months. This delay may explain why all our patients presented with cough and expectoration (100%) and a high incidence of haemoptysis (42%) compared to other studies **[23]**. Delay in presentation, also explains the low incidence of early cases in our study. Stage I disease represented only 44% of cases compared to 61% in other studies **[6,9,17]**. The establishment of a screening program, especially in high-risk groups will definitely help in detecting the disease in earlier stages, a higher chance for resectability and better survival. Risk groups include males 45 years of age of older, smoking at least one pack of cigarettes per day and those with occupational exposure risk factors **[29]**. The right lung was more affected by the disease in our study (60%). The right upper lobe was the commonest site (22%), while the right middle lobe was found to be the least site affected by the disease (4%). These results were found comparable to the results reported by Velzen et al. **[60]**. There was no explanation to this predilection site. More than half of our patients were assessed preoperatively to have tumors more than 5 cm in its greatest dimension (54%), while the majority of cases in other series were presented in earlier stages or even discovered before developing symptoms as reported by Martini et al. **[35]**.

The sensitivity of CT scanning in detecting mediastinal lymph nodes was 66.7%. The specificity was 82.9%, with total accuracy of 80%. Other authors reported CT sensitivity up to 85% **[62]**. Comparing the results of preoperative clinical and radiological staging with postoperative pathological staging, we will realize that there are many false results obtained from preoperative CT assessment for stages IIB and IIIA. Stage IIB cases were found preoperatively in 28% of the cases compared to 34% with pathological staging. Stage IIIA cases represented 22% of cases on preoperative radiological staging, compared to 18% of the cases on postoperative pathological staging. This indicates that depending upon CT scanning alone for preoperative staging is not adequate for assessment of the patient's operability. Other methods for evaluation, as mediastinoscopy, must be routinely included for adequate and preoperative proper staging.

Concerning the operative procedures for stage I disease, 83.3% of our patients were subjected to lobectomy. This is comparable to the results of Martini et al. **[35]** who reported that 85% of their patients in stage IB were subjected to lobectomy. The overall incidence of total pneumonectomy (52%) in our study is relatively high, compared to other reports (14%-26%) **[17,34,39,44]**, which may be explained by the delayed presentation of our patients. Chest wall resection was associated with lung resection in 12% of our patients, while it was reported in 4-6% of the patients in other studies **[1,2,4,9,40]**. Surgery related mortality in our study represented 8% of our patients (4 patients); 2 cases due to intra-operative hemorrhage and 2 cases due to ARDS. Of the 4 cases who died during the perioperative period, one patient was treated by lobectomy and 3 patients were treated with pneumonectomy. Surgery related mortality, in our study, for lobectomy and pneumonectomy was found to be 3.8% and 12.5%, respectively. Comparing these results to the operative related mortality reported by Wahi et al. **[61]** we would find that we have a relatively higher incidence of mortality following pneumonectomy. The

overall morbidity in our study (34%), in the form of sepsis and air leakage, was found comparable to the results reported by other authors (32%-36%) [20,61].

Adenocarcinoma was found to be the most frequent pathological type in our patients (38%). This result was found comparable to the results reported by Auerbach et al., Deversa et al., Hoffmann et al. and Ishida et al. [3,12,26,28].

Metastatic deposits were encountered, at two years of follow up in our study, in 13.6%, 41.2% and 44.4% of our patients in stages IB, IIB and III, respectively. Naruke et al. [45] and Nakahashi et al. [44] had reported metastatic deposits, at five years follow up, with the incidence of 27% for stage I, 50% for stage II and 70% for stage III. The incidence of metastatic deposits in our study was relatively low because we followed our patients for only two years. At the end of the two years, 44% of our patients were alive and free of disease and most of them (14 patients) were stage IB disease. The two-year survival for our patients by stage was 76.7%, 14.6% and 10.3%, for stages IB, IIB and IIA & B, respectively. Martini et al. [35], Albertucci et al. [1] and Allen et al. [2] had reported five-year survival rates of 75%, 37-52% and 26-30% for stages I, II and III, respectively. Node positive cases had less survival than node negative cases. The overall survival in our study was poor compared to other published studies and this may be explained by the relatively more advanced disease in our patients at presentation. However, the survival for patients presented at stage I disease was found comparable with other reported studies.

Univariate analysis was used to evaluate different prognostic factors. It proved that the most important prognostic factors that affect the outcome of the disease are, pathologic stage ($p < 0.001$), type of resection ($p=0.005$), pathologic type ($p=0.02$), duration of symptoms ($p=0.02$), tumor size ($p=0.03$) and lymph node status ($p=0.06$).

Conclusion:

Because of the generally disappointing overall survival results for the treatment of lung cancer, early detection is still the corner stone for improving treatment outcome. The survival rates achieved for stage I are much more superior than results reported for later stages. The stage of the disease is the most important prognostic factor, which has the greatest impact on treatment outcome. Effective screening in high-risk groups, by accurate survey, will help in early detection of lung cancer cases even before developing symptoms. Accurate preoperative staging, with dynamic CT scanning, MRI and mediastinoscopy, will help in deciding the suitable treatment policy. Addition of neoadjuvant chemotherapy has to be evaluated as a way for improving the overall results of the treatment of lung cancer. Chest wall invasion, partial pericardial involvement by the tumor, invasion of vertebral transverse processes, or invasion of mediastinal pleura does not exclude surgery as the primary treatment option. Establishment of anti-smoking programs, population educative programs and the out door pollution control will definitely result in decreasing the incidence of bronchogenic carcinoma.

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