EXTENDED MEDIASTINAL NODE DISSECTION FOR NON-SMALL CELL LUNG CANCER

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The most important factor influencing survival of surgical patients with non-small cell lung cancer (NSCLC) is the presence or absence of lymph node involvement. Considerable controversy still exists regarding surgical treatment for patients with mediastinal lymph node metastasis.

In 1960, Cahan [1] described the surgical procedure for "radical lobectomy" in which one or two lobes were excised in a block dissection of regional, i.e. hilar and mediastinal lymph nodes. Our procedures have been more extensive than Cahan's procedures. Routine systematic dissection of the mediastinal lymph nodes was performed in every case even if the preoperative evaluation was N0 or N1, in accordance with the lymph node map proposed by the Japan Lung Cancer Society (so-called Naruke-map)[2,3].

SURGICAL PROCEDURES FOR MEDICSTINAL NODE DISSECTION

To improve the survival of N2 patients, we modified the mode of lymph node dissection over the past 25 years [4-9]. Before 1980, the mode of lymph node dissection was less extensive compared with that of since 1981. Since 1981, we have performed systematic and extensive lymph node dissection in every curable case of non-small cell lung cancer (NSCLC), even if the preoperative evaluation was N0 or N1.

On the right side, the mediastinal pleura was longitudinally incised along the trachea and esophagus from the apex to the base of the right hemi-thorax. For node dissection in the superior mediastinum, the azygos vein was cut to mobilize the trachea, esophagus, and superior vena cava. All of the accessible lymph nodes in the superior mediastinum, i.e. the superior mediastinal (#1), para-tracheal (#2), pretracheal (#3), retrotracheal (#3p), and tracheobronchial angle (#4) nodes, were removed with the surrounding fat pad. The node anterior to the superior vena cava (#3a) was also routinely removed, including thymic tissue. By these procedures all of the lymph nodes and fat pad located around the subclavian artery, trachea, right main bronchus, ascending aortic arch, superior vena cava, and upper thoracic esophagus could be completely removed. For node dissection in the inferior mediastinum, the incised posterior mediastinal pleura was reflected and the pulmonary ligament was cut to expose the tracheal bifurcation, both main stem bronchi, the pericardium, and the lower thoracic esophagus. All of the lymph nodes in this compartment, i.e. subcarinal (#7), paraesophageal (#8), and pulmonary ligament (#9) and also contralateral hilar (#10) and paraesophageal (#8) nodes were dissected out with their surrounding fat pad. On the left side, lymph node dissection in the inferior mediastinum was performed similarly to that on the right side. However, in the superior mediastinum, there are great anatomical limitations on node dissection, which is in marked contrast to the right side. This is mainly due to obstruction of the surgical field by the aortic arch. As a routine procedure in left thoracotomy, the mediastinal pleura was incised just beneath the aortic arch and the subaortic(#5), paraaortic (#6), #7 and #8 nodes are removed.

In addition to the routine dissection method, two kinds of adjunctive procedures ((a) mobilization of aorta and (b) median sternotomy) have been performed for more extensive nodal dissection in the upper mediastinum. Since 1981, the aortic arch and part of the descending aorta are routinely mobilized by cutting Botallo's ligament and a few intercostal arteries to allow more extensive removal of the superior mediastinal nodes, i.e. #3, 3a, 3p and 4 nodes.

In addition to division of the Botallo's ligament, since 1986, the operative procedure was modified when left-sided N_2 lung cancer was diagnosed by preoperative CT scanning or discovered at thoracotomy. For more complete nodal dissection, median sternotomy was performed after procedures in the left hemithorax had been completed using the left postero-lateral approach. By this procedure, #1, 2, 3, 3a, 4, and 7 nodes in the ipsilateral side and also mediastinal and hilar lymph nodes in the contralateral side could be completely dissected [8,9]. By employing these dissection methods, improved survival of left N_2 patients was noted on comparison with that undergoing routine nodal dissection.

Hata et al. (10) reported excellent results by routine use of median sternotomy for left-side lung cancer in every stage.

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TUMOR DIAMETER AND INCIDENCE OF IYMPH NODE METASTASIS

In Table I, incidences of lymph node metastasis in relation to the size of the primary tumor are shown in 1255 patients with measurable tumor size. Overall, the incidence of N0, N1, N_2 and N3 diseases were 61.1%, 11.4%, 23.5%, and 4.1%, respectively. The incidence of N_2 disease increased as tumor size increased. Fifteen percent of patients having 11 to 20mm tumor size have N_2/N_3 diseases. When the tumor size increases to a range of 21 to 30mm, the incidence increases to 25%. If the tumor measures more than 30mm, more than 30% demonstrate N_2 disease.

Table I: Tumor size and frequency of lymph node metastases in NSCLC

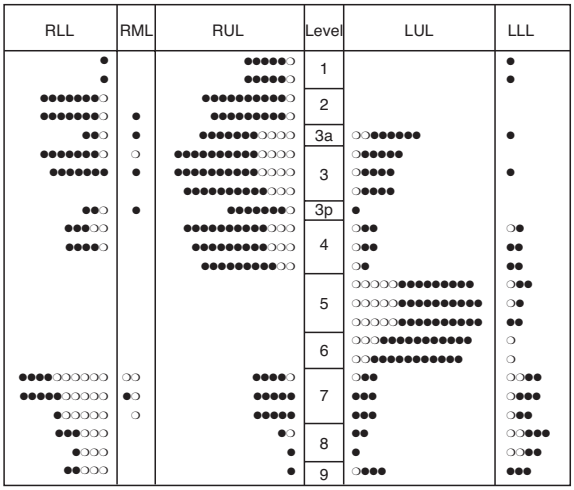
Tumor Size	NO	N1	N2	N3	Total
0-10mm	42(89.4%)	3(6.4%)	2(4.3%)	0	47(100%)
11-20mm	196(76.9%)	21(8.2%)	29(11.4%)	9(3.5%)	255(100%)
21-30mm	213(64.9%)	33(10.1%)	71(21.6%)	11(3.4%)	328(100%)
31-40mm	208(51.5%)	58(14.4%)	124(30.7%)	14(3.4%)	404(100%)
51-	108(48.9%)	27(12.2%)	69(31.2%)	17(7.7%)	221(100%)
Total	767(61.1%)	142(11.4%)	295(23.5%)	51(4.1%)	1255(100%)

METASTATIC SPREAD OF N_2 DISEASE

All dissected lymph nodes were sent for pathological examination. In this study, there were some patients with multiple metastatic lymph nodes within a single level, but such nodes were defined as one metastatic focus in this study. Figure 1 shows the distribution of mediastinal lymph node metastases in patients, who underwent complete dissection of the mediastinal lymph node. Open circles represent single-level metastases, and solid circles multi-level metastases. Upper lobe lesions involved more metastatic levels than lower level lesions. Common metastatic levels were #7, 4, 3, 2, and 5.

In patients with multi-level metastasis most of the metastases were noted in the regional lymph nodes, i.e. upper lobe lesion mostly involved the upper mediastinal nodes and lower lobe lesion mostly involved those in the lower mediastinum. However, in cases of right lower lobe tumors and left lower lobe tumors, metastases to the superior mediastinum (nonregional mediastinum) were observed more frequently than metastases of upper lobe tumors to the inferior mediastinum.

Figure I: Metastatic spread of N_2 disease in relation to the location of the primary tumor.



RLL: right lower lobe. RML: right middlle lobe. RUL: right upper lobe. LUL: left upper lobe. LLL: Left lower lobe

RATIONALE FOR EXTENSIVE IYMPH NODE DISSECTION

As indicated above, nodal spread of metastasis in the mediastinum is frequently noted and extensively scattered. Therefore, during surgery, extensive mediastinal node dissection should be performed. In addition, further rationale for extensive mediastinal node dissection are as follows: Firstly, even T1 lesion may induce high frequency of N_2 disease as shown in Table I. Secondly, the accuracy of CT scan in demonstrating N_2 disease is not very high. We did not use mediastinoscopy as a routine preoperative diagnostic procedure, and preoperative staging were mainly done by CT scan. The diagnostic rate of N_2 disease were sensitivity; 67%, specificity; 81% and accuracy; 77%. Thirdly, there is no method of detecting latent (microscopic) metastasis by gross intraoperative findings. Fourthly, there are many preoperatively unproven (latent) N_2 disease detected after postsurgical examination of the resected specimens. Among the 659 patients who were evaluated as N0 by preoperative evaluation, 89 patients (13.5%) had pN_2 disease verified by postoperative pathological examination. Furthermore, among the 269 patients with pN2 disease, 40% were diagnosed as cN0 (n=89) or cN1 (n=18) preoepratively.

RESULTS OF SURGERY

Since 1988, we have done radical extensive lymph node dissection in 1517 cases as a routine procedure. The mortality mortality within 30 days after operation were noted in 19 patients, constituting mortality rate of 1.2%. As a postoperative complication, 5 patients suffered from postoperative chylothorax with no mortality.

There were 218 stage IIIA-N_2 patients underwent resection with 2 (0.9%) operative mortality. Their operative radicality was 152 (70%) complete resection and 66 with incomplete resection. The 5-year survival rate of patients who underwent complete resection was 30%, whereas that of the incompltely resected cases were 5%. In total, the 5-year survival rate of the resected N_2 patients was 23%. The survival rate of the completely resected pN_2 patients who were evaluated as N0-1 preoperatively showed the 5-year survival rate of 36%, showing significantly better survival than that of the cN_2 patients which was 27%. There was a significant difference between the two groups. When prognostic factors affecting the survivals of patients with N_2 disease were analysed, favourable factors were complete resection, one-level metastasis, preoperatively unproven N_2 (cN0-1), T1-2N2M0, intranodal microscooic metastasis, without #7 nodal involvement and primary tumor less than 20mm. On the other hand, unfavourable factors were incomplete resection, multi-level metastases, radiologically evident N_2 disease, T3-4N_2 disease, extranodal expansion, number, #7 node metastases, or tumor more than 50 mm.

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