Invasion Beyond Interlobar Pleura in Non-small Cell Lung Cancer*

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**Study objective:** To assess the outcome of lung cancer with invasion beyond interlobar pleura and to clarify whether it should be treated in the same way as invasion to the parietal pleura or to other visceral pleura.

**Design:** Retrospective analysis.

**Setting:** Tokyo Medical College Hospital.

**Patients:** Eighteen resected non-small cell lung cancers with invasion beyond interlobar pleura were studied. The outcomes of those patients, those with parietal pleural invasion, and those with other visceral pleural invasion were compared. Patients with rib invasion, mediastinal organ invasion, or distant metastasis were excluded.

**Results:** The 5-year survival rate for patients with invasion beyond interlobar pleura was 34.2% and the median survival time was 56.5 months. The outcome was significantly better than that of patients with parietal pleural invasion. There was no significant difference between the outcome of invasion beyond interlobar pleura and that of other visceral pleural invasion. In patients without lymph node metastasis, similar results were obtained. There was no difference between the outcome of patients with invasion beyond interlobar pleura, who undergo lobectomy with a parietal resection of the invaded lobe, and that of patients with visceral pleural invasion, who undergo lobectomy.

**Conclusions:** The behavior of patients with invasion beyond interlobar pleura is different from that of patients with parietal pleural invasion and should be categorized as T2. The optimum operative method was lobectomy with only parietal resection of the invaded lobe to preserve the pulmonary function.

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**Key words:** interlobar pleural invasion; invasion beyond interlobar pleura; non-small cell lung cancer; outcome

**Abbreviations:** MST = median survival time

The TNM classification proposed by Union International Contre le Cancer states that a tumor invading the visceral pleura is classified as T2 and a tumor directly invading the chest wall, diaphragm, mediastinal pleura, or parietal pericardium is classified as T3. Tumors invading the surface of interlobar pleura are also T2. However, there is no clear definition what T factor should correspond to a tumor that invades an adjacent lobe beyond the interlobar pleura. The TNM classification did not include the adjacent pulmonary lobe as an adjoining organ corresponding with T3 or T4. Since the lymph flow of interlobar pleura is probably different from that of parietal pleura, the question arises whether the invasion beyond interlobar pleura should be considered separately from other pleural invasions. To clarify whether this type of invasion should be treated in the same way as parietal or mediastinal pleural invasion, resected non-small cell lung cancers with invasion beyond interlobar pleura were studied.

**MATERIALS AND METHODS**

Twenty-one lung cancer patients with invasion beyond interlobar pleura were treated surgically from 1980 to 1990 at Tokyo Medical College Hospital. Two patients with T4 disease and one with M1 were excluded from this study as these are poorer prognostic factors than pleural invasion. Therefore, a total of 18 patients with invasion beyond interlobar pleura were studied clinically and pathologically and the results were compared with those of patients with parietal pleural invasion, including mediastinal pleural invasion and diaphragm, and those of patients with other visceral pleural invasion treated during the same time period. Patients with rib invasion, mediastinal organ invasion, and pleural dissemination or distant metastasis were excluded from the series.
Table 1—TNM Classification According to Pleural Invasion

<table>
<thead>
<tr>
<th>Invasion Beyond Interlobar Pleura (Interlobar p3)</th>
<th>Visceral Pleural Invasion (p2)</th>
<th>Parietal Pleural Invasion (p3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N0M0</td>
<td>8</td>
<td>T2N0M0</td>
</tr>
<tr>
<td>N1M0</td>
<td>6</td>
<td>T2N1M0</td>
</tr>
<tr>
<td>N2M0</td>
<td>4</td>
<td>T2N2M0</td>
</tr>
<tr>
<td></td>
<td>18</td>
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</table>

There were 10 men and 8 women with an age distribution from 49 to 75 years. The tumors consisted of 12 adenocarcinomas and 6 squamous cell carcinomas. There were 8 N0, 6 N1, and 4 N2 diseases (Table 1). Lobectomy with parietal resection with a sufficient safety margin was performed in 10 patients, bilobectomy in 4, and pneumonectomy in 4. En bloc mediastinal lymph node dissection was performed in all patients. Six patients suffered relapses and died of lung cancer (one locoregional recurrence and five distant metastasis), and four died from pneumonia without recurrent disease and one patient, the cause of whose death was unknown, was treated as a cancer death. Two of the four deaths due to pneumonia occurred in the relatively early postoperative period. One patient was unavailable for follow-up. Six patients are currently alive and disease free.

Survival statistics were calculated using the methods of Kaplan and Meier. Group comparisons were made using the generalized Wilcoxon test.

RESULTS

The 5-year survival rate for patients with invasion beyond interlobar pleura was 34.2% and the median survival time (MST) was 56.5 months. That for patients with parietal pleural invasion was 13.6% and 27.8 months, respectively. These differences were statistically significant. However, there was no significant difference between the outcome of patients with invasion beyond interlobar pleura and that of patient with other visceral pleural invasion (Fig 1).

Statistically there were no significant differences between patients with invasion beyond interlobar pleura and patients with parietal pleural invasion or patients with other visceral pleural invasion in squamous cell carcinoma, because all patients with squamous cell carcinomas with invasion beyond interlobar pleura either died of a cause unrelated to cancer or were surviving, although there are no 5-year survivors, as yet. However, the 5-year survival rate for patients with invasion beyond interlobar pleura in adenocarcinoma was 29.2% and the MST was 51.6 months. The outcome was significantly better than that of adenocarcinomas with parietal pleural invasion. However, there was no significant difference between adenocarcinomas with invasion beyond interlobar pleura and adenocarcinomas with other visceral pleural invasion.

To clarify the effect of lymph node involvement, we divided all these patients into N0, N1, or N2 categories. Among N2 cases, there was no 5-year survivor among patients with invasion beyond interlobar pleura, and the MST was 21.4 months. There was no significant difference among patients with invasion beyond interlobar pleura, patients with other visceral pleural invasion, and patients with parietal pleural invasion. In N1 cases, there was no 5-year survivor among patients with invasion beyond interlobar pleura, and the MST was 41.3 months. There was no significant difference between patients with invasion beyond interlobar pleura and patients

![Figure 1. Survival curves in relation to type of pleural invasion.](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21874/ on 04/29/2017)
with parietal pleural invasion. The patients with other visceral pleural invasion were too small in number to evaluate statistically.

In N0 patients, the 5-year survival rate for patients with invasion beyond interlobar pleura was 50.0% and the MST was 72.3 months. This outcome was also statistically significantly better than that of patients with parietal pleural invasion. In this N0 series, patients with parietal pleural invasion had pT3N0M0 disease. There was no significant difference between patients with invasion beyond interlobar pleura and patients with other visceral pleural invasion. In this series also, patients with other visceral pleural invasion had pT2N0M0 disease (Fig 2).

Furthermore, we evaluated the outcome in relation to the site of the invaded pleura. The outcome of patients with invasion beyond interlobar pleura was better than that of patients with any other site of the invaded pleura, ie, parietal, mediastinal, or diaphragmatic pleura. The differences were statistically significant. There was no significant difference in outcome between parietal pleural invasion and mediastinal pleural invasion (Fig 3).

The outcome of 10 patients with invasion beyond interlobar pleura, who undergo lobectomy with a parietal resection of the invaded lobe, was compared with that of 18 patients with other visceral pleural invasion, who undergo lobectomy. The 5-year sur-
vival rate for the former patients was 44.4% and the MST was 51.3 months. The 5-year survival rate for the latter patients was 41.1% and the MST was 64.4 months. There was no statistically significant difference between these two groups. Excluding N2 patients, there was also no statistically significant difference between these two groups. There was only one cancer death among the patients treated with bilobectomy or pneumonectomy. However, in pneumonectomy patients, two died due to pneumonia in the residual lung.

**DISCUSSION**

We compared the outcome of lung cancer patients with invasion beyond interlobar pleura with that of lung cancer patients with other visceral pleural invasion (= T2) or parietal pleural invasion (= T3) to clarify what T factor should be assigned to patients with invasion beyond interlobar pleura. We excluded patients with rib invasion and mediastinal organ invasion because the prognosis of these patients was undoubtedly poorer than that of only pleural invasion cases. Therefore, our investigation was limited to only pleural invasion. The outcome of patients with invasion beyond interlobar pleura was better than that of patients with parietal pleural invasion, and there was no significant difference between the former and patients with other visceral pleural invasion. Similar results were obtained in N0 cases. The outcomes of all N2 cases were poor, which meant that there were no significant differences among any pleural categories. Therefore, the N factor is a more influential negative factor for prognosis than the degree of pleural invasion. The outcome in our series of patients with invasion beyond interlobar pleura was better than that of those with invasion of any other site of the parietal pleura. This suggests that invasion beyond interlobar pleura should be regarded as different from other sites of parietal pleural invasion. The outcome of patients with invasion beyond interlobar pleura was related to the degree of lymph node involvement rather than to the pleural invasion. Invasion beyond interlobar pleura should therefore be categorized as T2.

Since malignant tumors should be removed with surrounding organ to prevent dissemination, curative resection can be anticipated in lung cancer patients with invasion beyond interlobar pleura in which resection of the adjacent lobe is performed, suggesting that removal of the adjacent lobes to which tumor invaded, ie, bilobectomy, should be required. However, in patients in whom the left lung is diseased, bilobectomy means pneumonectomy. Among our patients, two of four pneumonectomy cases died of pneumonia in the residual lung.

If the tumor were resected partially, residual cancer at the resected margin, residual metastatic intrapulmonary lymph nodes, and accelerated lymphatic metastasis due to impaired lymph flow just below the visceral pleura must be considered. However, in our patients, only one patient had locoregional recurrence. Patients with invasion beyond interlobar pleura, who undergo lobectomy with a parietal resection of the invaded lobe, owe no survival disadvantage over patients with other visceral pleural invasion, who undergo lobectomy. Therefore, considering the quality of life, the optimal operative method for patients with invasion beyond interlobar pleura appears to be lobectomy with partial resection of invaded lobe. In patients with invasion to the incompletely separated lobe, lobectomy with partial resection is the optimal operative method for the same reason.

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**REFERENCES**