Effect of Radiation Therapy on Bronchial Obstruction due to Bronchogenic Carcinoma*


We evaluated the effect of radiation therapy in 57 patients with obstruction of a large bronchus with NSCC. Response with aeration of the atelectatic lung was seen in 12 patients (21 percent). Three patients (5 percent) showed partial response with persistent partial atelectasis, and nine patients (16 percent) showed good response with complete aeration of the atelectatic lung. In these patients the response appeared to be related to the dose of radiation. All of the patients who responded received more than 50 Gy. The difference in the response rate related to the dose of radiation was statistically significant (p<0.05). The rates were similar with all histologic types of NSCC. Regardless of the clinical response observed, bronchoscopy performed two to four months after completion of radiation therapy in 14 patients revealed persistent endobronchial tumor. There was no significant relationship between the persistence of endobronchial tumor, the dose of radiation therapy, and the tumor's histologic type. Of the 12 patients with radiographic improvement in atelectasis, fibrotic changes developed in four (33 percent) patients and pneumonitis in two (17 percent). Progression of disease with distant metastases occurred in 58 percent (seven) of the 12 patients who showed a clinical response of their bronchial obstruction. The median time to survival was nearly identical in responders and nonresponders. *(Chest 1989;95:582-84)*

Bronchogenic carcinoma of the large airways produces atelectasis and pneumonitis in about 20 to 30 percent of the cases.1 Radiation therapy is the accepted treatment of bronchial obstruction in order to improve or prevent atelectasis and obstructive pneumonia. In previous studies,2,3 the efficacy of radiation treatment of the atelectasis resulting from tumor obstruction has been evaluated by chest roentgenograms. These studies indicated a wide range of relief in bronchial obstruction. The atelectasis improved in SCC more often than in NSCC. These studies did not evaluate the incidence of local complications and the survival time of patients after radiation therapy. The purpose of our study was to evaluate the effect of radiation therapy on bronchial obstruction due to endobronchial tumor, to review the complications after radiation therapy, and to analyze the survival of patients so treated.

**Materials and Methods**

The bronchoscopy records at the VA Medical Center, Long Beach, were reviewed between Jan 1, 1980 and Dec 31, 1984 for individuals who had obstruction of a large airway (trachea, mainstem or lobar bronchi) due to bronchogenic carcinoma and who had a tissue diagnosis of bronchogenic carcinoma. We identified 164 such patients (all male) and reviewed the chest roentgenograms, the bronchoscopic findings, and the tumor registry records of these patients. The records of all patients were available for review. Thirty-one patients refused treatment, 12 patients underwent thoracic surgery, and 42 patients received chemotherapy or radiation therapy in a dose of less than 20 Gy. Twenty-two patients with SCC received chemotherapy and radiation treatment. These patients were excluded from the study. Fifty-seven patients with NSCC who received radiation treatment in a dose higher than 20 Gy and had adequate follow-up by our tumor registry were included in the analysis. The mean age of our patients was 65 years. Twenty-five patients had mainstem bronchial obstruction, and 32 had lobar bronchial obstruction. The following tabulation lists the 61 sites of obstruction in these 57 patients (numbers within parentheses are percentages):

<table>
<thead>
<tr>
<th>Obstruction Site</th>
<th>NSCC</th>
<th>SQCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachea</td>
<td>4 (7 )</td>
<td>4 (7 )</td>
</tr>
<tr>
<td>Mainstem bronchus</td>
<td>25 (41)</td>
<td>30 (53)</td>
</tr>
<tr>
<td>Lobar bronchus</td>
<td>32 (53)</td>
<td>32 (53)</td>
</tr>
</tbody>
</table>

The predominant cause of large bronchial obstruction and squamous cell carcinoma, as shown by the following tabulation listing numbers of patients (numbers within parentheses are percentages):

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>NSCC</th>
<th>SQCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenocarcinoma</td>
<td>10 (18)</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Large cell carcinoma</td>
<td>7 (12 )</td>
<td>7 (12)</td>
</tr>
</tbody>
</table>

At the time of radiation therapy, all patients with NSCC except three had stage III/II disease. The radiation was delivered by a 6-MeV linear accelerator at 1.8 to 2.0 Gy per treatment and five

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NSCC = non-small cell carcinoma; SQCC = squamous cell carcinoma.
treatments per week on a continuous schedule. The treatment portals were designed to include the site of bronchial obstruction and the involved area of pulmonary parenchyma, as well as the hilar and mediastinal lymph nodes. All patients were treated with a curative intent had planned total radiation doses of 35 to 60 Gy. The mean dose of radiation was 52 (30-61) Gy. Twenty-four patients (42 percent) received more than 50 Gy for curative intent, 12 patients (21 percent) received 50 Gy, and 21 patients (37 percent) received less than 50 Gy because their performance status deteriorated, they refused further radiotherapy, or they developed metastases outside the radiation portals. The response of the bronchial obstruction was assessed by serial chest roentgenograms. Expansion of atelectatic lung with full aeration was considered a good response. Partial aeration of the atelectatic lung was considered to represent an incomplete response. Evidence of new mass lesions, development of pleural effusion, or progression of atelectasis were considered to indicate progression of the disease.

RESULTS

Improvement in the atelectasis was observed in 12 (21 percent) of the 57 patients. The response was good in nine patients (16 percent) and incomplete in three patients (5 percent). The response rate tended to be higher in patients with lobar bronchial obstruction (10/32 or 31 percent) than in those with mainstem bronchial tumors (2/25 or 8 percent).

In patients with NSCC, the response to radiotherapy appeared to be related to the dose of radiation (Fig 1). All of the patients who responded received more than 50 Gy. Of the 19 patients who received more than 58 Gy, nine were responders. In contrast, of the 21 patients who received between 49 and 56 Gy, only three responded. This difference in response rate achieved statistical significance ($\chi^2 = 4.79$; $p<0.05$). None of the patients who received less than 50 Gy had a favorable response.

Table 1 shows the rate of response in relation to the histologic type of tumor obstructing the bronchus. There were no statistically significant differences between these response rates.

Fourteen patients had a second bronchoscopy. Persistent endobronchial tumor was found in all of them. Nine of these patients (64 percent) had received more than 50 Gy. At the initial bronchoscopy, all of these patients had almost complete obstruction of the bronchus. At the repeat bronchoscopy the obstruction had improved marginally in one patient but had not improved at all in the other eight patients. These findings suggest that it is unusual to completely eliminate endobronchial carcinoma in NSCC with radiotherapy, even when a dose of more than 50 Gy is given.

Radiation-induced changes could be objectively evaluated only in that of the 12 responders, radiation fibrosis was noted in four patients (33 percent) and pneumonia occurred in two patients (17 percent) (Table 2). The patient who developed the tracheoesophageal fistula received 60 Gy. Distant metastases and infections accounted for the death of most patients whose condition improved after radiation therapy. The median survival time of responders was similar to that of nonresponders (Table 3).

DISCUSSION

Endobronchial tumors manifest radiographically as atelectasis and pneumonitis in about 25 to 30 percent

![Figure 1. Relationship between radiation dose and radiographic response to radiotherapy in 57 patients with NSCC of lung.](image-url)
of the patients with carcinoma of the lung.\(^1\) Slawson and Scott\(^2\) evaluated the rate of improvement in 330 patients with bronchogenic carcinoma after thoracic irradiation. They reported that 23 percent of their patients with atelectasis showed improvement, which is similar to the rate found in the present study. These investigators\(^3\) did not analyze the relationship between improvement and the dose of radiation therapy. Our response rate is less than that reported by Majid et al.,\(^4\) who evaluated the response of atelectasis to radiation therapy in 33 patients and observed complete or partial reexpansion of the atelectatic lung in 61 percent of the patients with NSCC.

When we analyzed the response of atelectasis relative to the histologic type and the dose of radiation, we found that all of the patients with NSCC who responded received at least 50 Gy. These results are in variance with those of Majid et al.,\(^5\) who noted a response rate of 46 percent in patients with NSCC treated with less than 50 Gy. We observed a higher rate of response in cases of lobar bronchial obstruction than in mainstem bronchial obstruction. It is likely that mainstem bronchial obstructions are associated with larger tumors and, therefore, are more difficult to treat successfully.

We performed bronchoscopy during the follow-up period in 14 patients whose chest roentgenograms were questionable in terms of response. The finding of residual endobronchial tumor in all of these patients was noteworthy; it could not be correlated either with the dose of radiation or with the histologic type. Intrathoracic failure to control NSCC with radiation therapy has been reported to be dependent on the tumor stage and the dose of radiation. Previous studies have suggested a tumor sterilization rate of 35 percent after radiation.\(^4\),\(^5\)

Radiation therapy was associated with significant complications in this series. Radiation fibrosis occurred in four of the 12 patients who responded to the treatment. These patients received 50 Gy or more. The median survival time of responders and nonresponders was similar in our groups, suggesting that the improvement in atelectasis alone is not sufficient to improve the overall prognosis of patients with carcinomatous bronchial obstruction.

In conclusion, the present study demonstrates that one can expect approximately a 20 percent response rate in patients with bronchogenic carcinoma when they are treated with radiotherapy for bronchial obstruction. In patients with NSCC, a higher response rate can be achieved when the dose of radiation approaches 60 Gy; however, since it appears that the tumor is rarely eliminated with high doses of radiation therapy and since the life expectancy is not increased in those with radiologic responses and since higher radiation doses are associated with more side effects, one must question the utility of high-dose radiation therapy in this situation. We believe that faster palliation with fewer side effects is probably achieved with laser therapy.

**References**


\(^2\) Slawson RG, Scott RM. Radiation therapy in bronchogenic carcinoma. Ther Radiol 1979; 132:175-76

