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High-dose-rate brachytherapy in symptom palliation due to malignant endobronchial obstruction: A quantitative assessment

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ABSTRACT

PURPOSE: This study was performed to objectively evaluate the effect of high-dose-rate endobronchial brachytherapy (HDREB) in symptom palliation of patients with malignant airway obstruction and treatment-related toxicity.

METHODS AND MATERIALS: Seventy-eight patients were treated with palliative intent according to a prospective observational protocol. HDREB was delivered in three fractions of 7.5 Gy at weekly or fortnightly intervals, associated or not with external beam irradiation. Most patients presented with lung cancer primaries and were treated because of lesions located in the trachea and/or main bronchi. Performance status, degree of obstruction, and symptom palliation were graded according to an objective score index, defined before and after HDREB at the last followup visit. Survival was considered from the end of HDREB for at least 3 years or until death.

RESULTS: Overall, there was a 70% improvement, with migration of patients from lower to higher performance status. Bronchial obstruction was improved in 73.4% of the patients. The symptom that presented the better response was hemoptysis (100% complete relief) followed by postobstructive pneumonia (80%), dyspnea (57.4%), and cough (33.9%). Median survival was 6 months and improved in patients with complete response at bronchoscopy (9 months). There were two (2.6%) cases of bronchial fistulae and eight cases (10.2%) of fatal hemoptysis.

CONCLUSIONS: HDREB is an excellent modality for palliating malignant airway obstruction resulting in quality of life improvement, with a good tolerance, patient compliance, and low rate of complications.

Keywords: Lung cancer; Brachytherapy; Palliative treatment; Airway obstruction; Hemoptysis; Radiotherapy

Introduction

Endobronchial brachytherapy is a well-established irradiation method for palliation of symptoms because of malignant endobronchial obstruction. It can be delivered with low-dose-rate brachytherapy (one treatment taking hours or days) or with high-dose-rate brachytherapy (fractionated treatment delivered in a few minutes). High-dose-rate brachytherapy is delivered with an iridium-192 source with 10 Ci nominal activity. The source is driven into molds, catheters, or needles placed in the patient, through a computerized remote afterloading system that allows no contact of the staff with radiation. High-dose-rate endobronchial brachytherapy (HDREB) is a rapid procedure, delivered on an outpatient basis, under local anesthesia. The main indication is for bronchial desobstruction because of endobronchial malignant disease where the endobronchial component predominates over the extrinsic one. The rapid falloff of radiation dose within distance in brachytherapy allows a more localized treatment of the tumor, while sparing a great amount of surrounding normal tissue.

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Lung cancer has shown an increasing incidence since the second half of the XIX Century and is the most commonly diagnosed cancer worldwide accounting for 13% (1.6 million) of the total cases and the leading cause of cancer death in men and the second in women, comprising 18% (1.4 million) of the deaths in 2008 (1). In Brazil, the National Cancer Institute estimated for 2012, 17,210 new cases of lung cancer in men and 10,110 in women. These values correspond to an estimated risk of 18:100,000 new cases in men and 10:100,000 in women (2).

During the progression of the disease, almost 30% of all lung cancer patients will develop symptomatic airway obstruction, commonly resulting in cough, dyspnea, hemoptysis, and postobstructive pneumonia that will negatively affect the quality of life. Also, other malignant diseases may cause respiratory symptoms because of bronchial obstruction. In this situation, the restoration of airway patency to relief distress from symptoms is the most important goal (3, 4).

Palliation of symptoms can be achieved with laser treatment, debulking forceps biopsy, electrocautery, cryotherapy, endobronchial stent placement, and photodynamic therapy, but the duration of palliation is limited once neoplastic proliferation patterns are not altered (5–8). HDREB offers the potential of increased efficiency in the control of obstruction symptoms and duration of palliation. It is a rapid procedure, delivered on an outpatient basis, under local anesthesia, and can potentially improve patient's symptoms and quality of life. HDREB can be used individually or in combination with other modalities, even in previously irradiated patients (9, 10).

This study was performed to objectively evaluate the effect of HDREB in symptom palliation of patients with malignant airway obstruction and treatment-related toxicity.

Methods and materials

From January 1991 to December 2008, 103 patients with primary or secondary bronchogenic neoplasms were treated with HDREB using a microSelectron-HDR (Nucletron, an Elekta company [Elekta AB, Stockholm, Sweden]) at the Radiotherapy Department of Hospital das Clínicas of the University of São Paulo, Brazil.

All patients had biopsy and bronchoscopy-proven tracheobronchial malignancy and were treated in a prospective HDREB protocol regarding curative or palliative treatment intention. The protocol was approved by the ethical committee of the institution.

Brachytherapy protocol included three fractions of 7.5 Gy, in weekly or fortnightly intervals. In a few patients, in whom there was a risk of hemoptysis because of tumor location near great vessels, three or four fractions of 5 Gy each were prescribed. When the obstruction was associated with a significant extrinsic component, external beam irradiation was indicated (conventional 30 × 2 Gy or 10 × 3 Gy for palliative cases), and brachytherapy was performed in sequence. Patients with previous irradiation were treated with brachytherapy alone.

Of the 103 patients, 4 with primary tracheal tumors, previously reported (11), and 21 with lung cancer who were treated with curative intent were excluded from this analysis, though 78 (75.7%) patients who received palliative treatment were the subject of this study. Patients' characteristics are shown in Table 1. The median age was 61 years ranging from 29 to 82 years. There were 60 men and 18 women. Eastern Cooperative Oncology Group (ECOG) performance status (PS) was 0–2 in 88.5% of the patients. There were 65 (83.3%) patients with primary lung cancer, most with non–small cell histology (93.8%). Lung cancer was presented initially as Stage IV in 15 patients, and 13 patients presented symptoms because of endobronchial metastatic disease from melanoma, breast cancer, squamous cell carcinoma of the uterine cervix, esophageal squamous cell carcinoma, rectal cancer, colon adenocarcinoma, and hypernephroma, respectively. Most patients (73.1%)

Table1
Characteristics of the 78 studied patients

Characteristics	Number of patients (%)
Gender	
Male	60 (76.9)
Female	18 (23.1)
Age (y)	
<60	37 (47.4)
≥60	41 (52.6)
ECOG PS	
0	5 (6.4)
1	45 (57.7)
2	19 (24.4)
3	9 (11.5)
Primary tumor	
Lung	65 (83.3)
Others	13 (16.7)
Histology	
Lung cancer	
Squamous cell	46 (59.0)
Adenocarcinoma	8 (10.3)
Large cell	1 (1.3)
NSCLC	6 (7.7)
Small cell	4 (5.1)
Others	13 (16.7)
Central lesion (trachea/main bronchi)	
Yes	57 (73.1)
No	21 (26.9)
Number of HDREB fractions	
<3	13 (16.7)
3	58 (74.4)
>3	7 (9.0)
Associated treatments	
Laser debulking	15 (19.2)
External beam irradiation	42 (43.8)
Chemotherapy	30 (38.5)

ECOG PS = Eastern Cooperative Oncology Group performance status; NSCLC = non–small cell lung cancer; HDREB = high-dose-rate endobronchial brachytherapy.