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## Workshop endobronchial brachytherapy (methodology)

# Endobronchial brachitherapy. Performing the procedure

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## 1. Introduction

Endobronchial brachytherapy alone or as part of a multimodal treatment, has a distinct role as palliative treatment in advanced lung cancer and as a curative treatment in selected cases of tumors confined to the bronchial wall.

The safety and effectiveness of the procedure are optimized by a multidisciplinary approach that includes an expert bronchoscopist, a radiation oncologist and a radiation physicist, supported by a dedicated nurse and radiotherapy technician.

Next we describe the methodology used in our center, where we have the experience of 7 years in treating 37 tumors in 31 patients. In 20 cases (64.5%), they had curative intent and 11 (35.5%) palliative intent. On 14 occasions, prior External Beam Radiation Therapy was used and in 7 cases was associated with other debulking methods. Overall, after a month of treatment, there was clinical improvement in 73.7% and endoscopic improvement in 87%. The complete response of the treated area for curative treatments was 70% at 1 month and 66.7% at 1 year. There were serious complications in 9.7% of cases.

## 2. Material resources required

A Videobronchoscopy tower with the ability to record images and videos. A therapeutic flexible bronchoscopes with a working channel of at least 2 mm. Suction system, Oxygen delivery system, and Fluoroscopy equipment. A polyethylene Catheter applicator 5 or 6 Fr. A simulation "dummy" wire. A CT for Image Acquisition, a computer assisted 3D dosimetric Planner and a $^{192}$Ir remote after loading unit.

## 3. The procedure

The candidate cases are discussed for treatment in the Brachytherapy Committee.

Once the case is accepted, we update if necessary, CT images and bronchoscopy to assess specifically the exact size and location of the tumor, degree of bronchial obstruction, lesion length, permeability and viability of distal airway or need of other debulking methods.

On the day of treatment, the patient is prepared as for a flexible bronchoscope, fasting of at least 4 h, a permeable intravenous access and supplemental oxygen administered by a modified venturi mask. We proceed to EKG, blood pressure and pulse oximetry monitoring. Then, the patient is placed in supine position in a specially designed operating table, which allows transport without mobilize.

We used bronchoscopist administered conscious sedation, using IV midazolam and fentanyl, lidocaine topical anesthesia for the nasal passages and pharynx and cricothyroid puncture for the vocal cords. The flexible bronchoscope is inserted preferably using a transnasal approach (which will facilitate the subsequent anchoring); if not possible, can be inserted through the mouth, through endotracheal tube and even through a tracheostomy stoma.

The distal end of the catheter is placed at the site of the endobronchial tumor and it should be at least 1 cm beyond the distal end of the lesion, and anchored if possible into a segmental bronchus for minimizing any displacement. In case of bronchial stump, it requires great experience with the catheter stiffness, elasticity and torque for optimal placement in close contact with the lesion.

The bronchoscope is then withdrawn, leaving the catheter in situ with the aid of fluoroscopy and a scalated dummy

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seed probe is placed to simulate the pathway of the radiation source. The proximal catheter anchoring to the nose, mouth, endotracheal tube or tracheostomy, is performed with adhesive strips, and a new bronchoscopy to check the proper placement is performed if necessary.

A second and third catheter may be placed in similar fashion if necessary, to optimize the dose distribution in tumors affecting carinae or in cases of multiple tumors.

Next, the patient is moved to the radiology area, for a chest CT image acquisition that includes the area of the lesion with wide margins.

The images are sent via intranet to the virtual simulation console, where the radiotherapy oncologist with the assistance of the bronchoscopist, proceeds to define the volume to be treated and adjacent critical organs if any (esophagus, great vessels, etc.).

The target volume is newly transferred from the virtual simulation console to the 3D planner, where the radiation oncologist, with the assistance of the radiation physicist, sets the most appropriate treatment plan.

Meanwhile, the patient is transferred back to the treatment area. The control of cough is achieved using fentanyl. If necessary, new radiological control is performed to check that it has not moved the catheter, in which case there would have to repeat the whole of process.

The treatment takes place in a shielded room. After removal the dummy seed wire, the catheter is connected to the $^{192}$Ir remote after loading unit, and the source is moved through the applicator to the programmed locations, controlled from a computer, using a motor driving system, with the patient constantly controlled by a closed TV circuit.

After finished the treatment, the catheter is removed, and the patient is kept under observation for 2 h, until discharge. During this time the pulmonologist controls and eventually attends any acute complications related to the procedure (bronchospasm, pneumothorax, arrhythmia . . .).

Unless complications or patient status forbid, the treatments are performed on an outpatient basis with weekly fractions until the total dose is complete.

Once completed the whole treatment (between 2 and 6 fractions), both clinical and bronchoscopic controls are performed, after 1 month on palliative treatment, and at 3, 6 and 12 months in case of curative one, in order to determine the degree of response and possible occurrence of late complications.