

Bronchoscopic Laser Resection

By Daniel Haim, M.D., FCCP



Bronchoscopic laser resection is used to relieve airway obstruction due to benign or malignant intraluminal airway obstruction, particularly exophytic proximal airway lesions, but have little or no role when the obstruction is caused by an extrinsic compression.

Malignant disease-Airway obstruction from bronchogenic carcinoma is the most frequent indication for laser resection. It is typically employed in patients who have exhausted their therapeutic options, although some may be eligible for salvage chemotherapy, brachytherapy or surgical resection. Other malignant causes of central airway obstruction that have been managed by laser resection include adenoid cystic carcinoma, mucoepidermoid carcinoma, endobronchial metastasis from melanoma, colon, kidney and breast cancer.

Benign disease- Airway obstruction due to a benign lesion may also be amenable to laser resection. Such lesions include a foreign body, stenosis due to granulation tissue, intubation injuries, post radiation strictures, or strictures due to bronchial resections or web-like structures from inhalation injuries or infections.

Patients who have benign strictures due to causes other than infection should always be considered for open surgical resection. Candidates for bronchoscopic laser resection include those who are not candidates for open resection because of age, poor medical status, fear of surgery, extent, location, and degree of the stricture.

The laser that is most commonly used for bronchoscopic laser resection is the Nd: YAG Laser (Neodymium, Yttrium, Aluminum, Garnet Laser). Its energy is delivered through flexible fibers that are inserted through a rigid or flexible bronchoscope.

The wave lengths of this laser (is 1,064 nm) is invisible, thus a red helium neon beam is used to indicate where the laser energy will be applied.

Nd: YAG Laser can remove an obstructing airway lesion in two ways:

LASER RESECTION

Laser resection involves directing the laser at the target lesion, devitalizing the lesion via photocoagulation of the feeding blood vessels and then extracting the devitalized tissue through the bronchoscope. This is possible because the laser penetrates tissue to a depth of up to 10 mm in an inverted cone fashion and provides reliable photocoagulation at this depth.

VAPORIZATION

Laser vaporization entails aligning the laser beam parallel to

the bronchial wall and aiming at the edge of the intraluminal lesion. Laser pulses of 1 second or less are used to vaporize the tissue. This is possible because the energy from the laser is relatively well absorbed by water.

The major disadvantages of the Nd: YAG Laser is the operator's inability to predict the extent of deep tissue damage based upon the surface appearance. If the power density increases at sufficient depth below the surface of the target tissue, the temperature can increase above boiling point of water. Explosion of a pocket of steam causes "popcorn effect" which may result in tissue perforation, rupture and hemorrhage.

PROCEDURE

The choice of rigid versus flexible bronchoscopy depends on the bronchoscopists's experience and preference, as well as whether vaporization or resection of the lesion is planned. When resection of the lesion is planned, rigid bronchoscopy is used and when vaporization of the lesion is planned flexible bronchoscopy is used.

After it has been determined whether the procedure will be performed via rigid or flexible bronchoscopy, appropriate personnel need to be recruited. Mostly the resection teams are comprised of a bronchoscopy, and anesthesiology who is experienced with interventional pulmonary techniques and airway management, and endoscopy nurse familiar with the equipment, and a second endoscopy nurse who assists the bronchoscopist and controls the laser settings.

Once the patient is sedated and the airway is secured, the procedure can begin. Muscle relaxants and paralytic agents can occasionally be helpful in preventing the patient from coughing or moving during the procedure. The use of these medications should be minimized as much as possible.

Bronchoscopic laser resection should only be performed by bronchoscopists who have advanced training and experience. Bronchoscopists and team members should remain familiar with techniques, potential complications and necessary precautions.

Precautions during laser resection include wearing protective goggles, protecting patient's eyes, avoiding injury from accidental laser scatter, and minimizing the risks of combustion.

The fraction of inspired oxygen should be kept below 40% during laser firing.

Video systems allow all personnel to observe the procedure

which makes it easier for assistants to anticipate any difficulties or complications. Many bronchoscopic laser procedures are performed in less than one hour.

COMPLICATIONS

Complications are infrequent, but they include hemorrhage, airway wall perforation, airway wall necrosis, and fistula formation. Arterial air embolism rarely complicates bronchoscopic laser resection, but can lead to myocardial ischemia or cerebrovascular accidents.

OUTCOMES

Outcome data is sparse, but in one large study in patients with malignant airway obstruction it was found that the airway patency improved and symptoms were palliated in over 90% of patients. Mortality was less than one percent within seven days from the procedure.

Emergency laser resection can favorably affect healthcare utilization. Rapid patient improvement is frequently observed.

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