

## Bronchoscopic Laser Resection of Endobronchial Tumours

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### Abstract

Bronchoscopic laser resection is carried out to relieve obstruction caused by endobronchial lesions which result in persistent cough, increasing breathlessness and infection due to retained secretions and which is usually accompanied by collapse distal to the site of obstruction. This method of resection helps in endobronchial tumour debulking. Bronchoscopic laser resection is rapid and suitable for life-threatening intraluminal airway obstructions. It uses different gases such as Nd:YAG, CO<sub>2</sub> and a diode laser. Complications though possible are minimal if the procedure is conducted by experienced personnel in a well-equipped respiratory unit.

**Keywords:** Bronchoscopic Laser; Endobronchial Tumours; Nd:YAG

At least 30% - 35% of patients with primary bronchogenic carcinoma present with endobronchial lesions at the time of diagnosis, resulting in obstructive symptoms as the disease worsens [1,2].

When the tumour obstructs the large central airway (trachea) and/or the main stem bronchi the patient develops acute symptoms of breathlessness and asphyxia which is very debilitating. However, if the tumour obstructs one or more of the secondary and tertiary bronchi the patient usually develops a persistent cough, increasing breathlessness and symptoms of infection due to retained secretions and collapse distal to the site of obstruction.

By the time a malignant endobronchial lesion is detected, the patient is usually inoperable and while palliative radiotherapy may help to reduce the tumour mass burden, collapse is relieved in only 21% of cases [3].

Hence, interventional laser bronchoscopy serves as a linchpin in the palliative treatment of such malignant tumours [4]. However, curative treatment of benign endobronchial tumours is also possible with bronchoscopic management using laser resection [5-8].

### Bronchoscopically-guided laser resection of endobronchial tumours

Endoscopic laser resection is a commonly used technique for endobronchial tumour debulking.

This method is rapid and therefore very suitable for life-threatening intraluminal large-airway obstructions.

Endobronchial laser treatment requires the application of laser energy delivered through a rigid or flexible bronchoscope and is usually given under sedation (flexible bronchoscopy) or general anaesthesia (rigid bronchoscopy).

It uses different gases such as Nd:YAG, CO<sub>2</sub>, a diode laser, argon ion, excimer, alexandrite and potassium titanyl phosphate to rapidly photocoagulate and destroy the intraluminal tumor mass [9,10].

Nd-YAG is the most commonly used laser for endobronchial lesions. It emits energy at a wavelength of 1,064 nm [11-13]. It is used at 10 - 40 W, but its power output can increase up to 100 W. The depth of the tissue which can be affected by the laser varies from several millimeters to several centimeters depending on the power output.

The results are quite instantaneous in virtually 92% of cases with better results for proximal as compared to distally located tumours [14].

Hemorrhages are not uncommon but can be effectively controlled by adrenaline, local instillation of terlipressin, cold serum, compression with the tube, or short electrical pulses of < 30 W. Severe hemoptysis only occurs in 1% of cases [2,15,16].

Training in laser safety is a prerequisite for all members of the endoscopy department. A dedicated member of the group should be entrusted with the task of ensuring that the correct laser power settings and pulse durations are employed.

Eyes are susceptible to stray laser radiation. Therefore, all staff present in the endoscopy room should wear protective eye goggles.

When employing endobronchial laser treatment, care should be taken to avoid the risk of an airway fire. The bronchoscopist should make sure there are no inflammable objects within the airway such as non-laser-proof endotracheal tubes and stents. The anaesthetist should also regulate the inspiratory oxygen fraction during treatment to less than 65% as this oxygen level offers a safe environment when using diode and Nd-YAG lasers in combination with flexible and rigid bronchoscopes. In addition, the pulmonologist (bronchoscopist) should ensure that the laser is only fired when the tip of the optical fibre protrudes beyond the tip of the bronchoscope in order to avoid thermal damage.

The anatomical location of the endobronchial tumour correlates well with the level of patient improvement, with central airway tumours showing greater improvement than those which are more peripherally located [17].

In one study, patients with centrally-located tracheal tumours presenting with severe respiratory distress, when treated with laser therapy showed dramatic improvement in their symptoms and lung functions, with improvements in peak expiratory flow (PEF) between 26 and 512%, three days following treatment [18].

Patients with central airway tumours are frequently misdiagnosed as COPD or bronchial asthma and are only correctly diagnosed at a later stage when there is evidence of asphyxia [19,20]. In such cases, tumour debulking with laser provides immediate symptomatic relief following which the correct diagnosis may be made [21,22].

Treatment for peripheral endobronchial obstruction produces less dramatic improvement. Tumours obstructing major bronchi not only impair ventilation but also reduce perfusion by compressing on the pulmonary vessels. Although resection of the endobronchial tumour may lead to improved ventilation, it may not have significant effect on perfusion leading to an increase in "dead space" within the lung.

However, in a study of 28 patients with endobronchial obstruction in which radionuclide lung scans were performed immediately before and three days after laser resection [23,24] improvement in both ventilation and perfusion scores were seen in the treated lung accompanied by improved symptom scores and improved 6-minute walking distances [23,24]. It was further explained that the improvement in perfusion occurred as a result of a correction in alveolar hypoxia after successful airway recanalisation.

Bronchoscopic laser resection has also been found to be particularly effective in the treatment of endobronchial carcinoid tumours and is preferred over more conventional surgical methods in patients with classic carcinoids that are poor surgical candidates [25,26]. However, the advantage of tissue preservation must be balanced against the risk of having misjudged the malignant nature of the tumour mass.

The major complications of laser therapy include, perforation of the tracheobronchial wall, mediastinitis and gas embolism [27,28]. These complications can be avoided by adopting a tangential axis of treatment and a non-contact approach, keeping the laser probe at least 1 cm away from the tumour mass.

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