ORIGINAL RESEARCH ARTICLE

Tanaffos (2002)1(1),36-40

Treatment of Post-intubation Tracheal Stenosis with Nd-YAG Laser

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ABSTRACT

Background: *Tracheal intubation is a very common procedure for maintaining patency of airway in critically ill patients. Intubation may lead to local complications such as tracheal destruction and post-intubation stenosis. There are two different therapeutic approaches for such patients. The first one is surgical end-to-end anastomosis suitable for severe destructions and fibrosis formations. The second and novel method is utilization of Nd-YAG Laser that can correct intraluminal airway lesions including webs, granulation tissues and fibrous bands. Nd-YAG laser employment decreases hospitalization period, complications and, expenses; in addition, it saves medical staff's time and energy.*

Materials and Methods: *An uncontrolled clinical trial was performed in post-intubation tracheal stenosis cases admitted to "National Research Institute of Tuberculosis and Lung Disease" (NRITLD) between 1994 to 1999. Bronchoscopy was performed for all patients, and those with the following inclusion criteria underwent Laser therapy: length of stenosis less than 2 cm, tracheal lumen diameter more than 5mm, and granulation tissue type lesions. Patients who did not meet the aforementioned criteria were referred for surgical interventions. Laser therapy was employed by fiberoptic bronchoscopy under local anesthesia. For those patients with tracheal lumen diameter between 5-10 mm rigid bronchoscopy was performed under general anesthesia.*

Results: *Of 32 patients, 25 met the primary criteria for Laser therapy, from which 22 (88%) were completely cured. Because of poor general condition, 5 of 7 other patients who had been referred for surgery, underwent Laser therapy, therefore a total of 30 patients (93%) took advantage of this technique. Overall, 23 patients were treated only with Laser therapy, 2 patients only with surgery and 7 patients with a combination of these two approaches.*

Conclusion: *This trial revealed that if patients with post-intubation tracheal stenosis are selected correctly, Laser therapy can be used as a beneficial and safe method with satisfactory results.* ***(Tanaffos 2002; 1(1):36-40).***

Keywords: *trachea, stenosis, laser.*

INTRODUCTION

Endotracheal intubation maintains an appropriate airway for ventilation of the critical patients. Appropriate maintenance of endotracheal tube is of the outmost importance. Utilization of high pressure cuff with pressure more than 12-15 mm Hg, not inflating and deflating the cuff intermittently, excessive movements of patient and wrong placement of the tube all may lead to severe complications such as glottis edema, pseudomembrane formation, tracheomalacia,

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cartilage destruction, granulation tissue formation, and tracheal stenosis. It seems as if genetic predisposition may also be effective in these diseases (1-2).

Employment of high pressure cuffs causes ischemia and cartilage destruction which result in fibrosis and structural stenosis. Granulation lesions and tracheal webs appear because of displacement and sliding of tracheal tube. Before the advent of Laser technique, end-to-end anastamosis surgery was the only remedy for the patients with airway obstructive symptoms especially dyspnea and cough. Utilization of Neodymium Yttrium-Aluminum-Garnet (Nd-YAG) Laser has opened a new horizon in the treatment of such patients (3-5). Laser fiber is passed through bronchoscope and Nd-YAG Laser beam is utilized in order to treat subglottic lesions (1,2,6,7).

The outcome of an uncontrolled clinical trial in 32 cases who were treated with Nd-YAG Laser between 1994 and 1999 with post-intubation tracheal stenosis is presented in this report.

MATERIALS AND METHODS

An uncontrolled clinical trial was carried out over the patients suffering from post-intubation tracheal stenosis admitted to NRITLD between 1994 and 1999 to assess the outcome of Nd-YAG Laser therapy.

The study population consisted of all patients being referred to the hospital consecutively, regardless of gender and age. Following the bronchoscopy, the cases were distributed in two groups: those with stenosis length less than 2cm, tracheal lumen diameter more than 5mm, and granulation tissue type lesions were selected for Laser therapy, and the rest were referred for surgery.

Laser therapy was performed with “Trimedyne 150 Watt” in all patients. For the majority of the patients Laser therapy was conducted through fiberoptic bronchoscopy under local anesthesia. Patients with tracheal lumen diameter between 5-10 mm were treated under general anesthesia by rigid bronchoscope (Storze).

Different levels of Laser power exert different effects on the tissue. Laser power between 25-30 watt causes photocoagulation or hemostasis and power between 25-30 watt results in cutting of tissue. Using Laser power over 40 watt causes burning and photoevaporation. Nd-YAG Laser incises webs in the middle part and photoevaporation is performed on the two sides of incision (3,8,9). The above-mentioned characteristics have been employed intermittently as required, for all cases.

In circular lesions with severe stenosis, lumen diameter was dilated by rigid bronchoscope and Nd-YAG Laser was employed to incise at 3,6 and 9 o’clock positions, then photoevaporation was performed on each side.

In some cases, a band crosses one side of trachea to the other side and leads to tracheal rotation and stenosis. Cutting this band returns the trachea to its normal position and stenosis is successfully recovered as well.

RESULTS

The study population included 23 men and 9 women, aged 6-65 years. The most common cause of intubation was car accident (50%) followed by surgery, coma, and trauma.

Bronchoscopic studies revealed that 27(84%) cases had lesion length of less than 2 cm and 30(94%)had tracheal lumen diameter of more than 5m, meanwhile granulation tissue type lesions were reported in 26 (81%) patients.

Hence, 25 (78%) met the primary criteria for Laser therapy intervention. Since 7 patients were not eligible, they were referred for surgery, of whom 2 cases were referred for Nd-YAG Laser therapy again because of poor general condition. As a result a total of 27 (84%) patients underwent Nd-YAG Laser therapy intervention. Of 25 cases initially proposed for Laser therapy, 22 (88%) were successfully treated and 3 other patients who failed

treatment (with 3.3 sessions of Laser therapy on the average) were introduced for surgical interventions.

Table 1. Therapeutic approaches for cases with tracheal stenosis due to intubation admitted to NRITLD between 1994-1999.

Therapeutic approach	Number of patients
Laser therapy only	23
Surgery	2
Laser therapy-surgery	3
Surgery-Laser therapy	3
Laser therapy-surgery-Laser therapy	1

Table 2. Duration of endotracheal intubation in patients with post-intubation tracheal stenosis referring to NRITLD between 1994 to 1999.

The duration of Endotracheal intubation (day)	Number of patients (%)
<1	2(6.3)
1-3	1(3.1)
3-5	5(15.7)
5-7	6(18.7)
7-9	2(6.3)
9-11	1(3.1)
11-13	3(9.4)
2-3 week	2(6.3)
3-4 week	0(0)
More than 4 weeks	10(31.1)
Total	32(100)

Of two aforementioned patients who were not eligible for operation, one patient was completely improved and the other one was prepared for surgery after palliation of the symptoms. Of the first 5 surgery candidates, 3 cases were proposed for Laser therapy, due to failure of complete improvement with surgery. Different employed therapeutic approaches are shown in Table1.

Totally 30 patients took advantage of Nd-YAG Laser therapy, of whom 23 were successfully managed only with Laser therapy.

Table2 shows the duration of intubation period leading to endotracheal stenosis and Table3 demonstrates the interval between ex-tubation and appearance of obstructive symptoms.

Table 3. Interval between ex-tubation and appearance of obstructive symptoms in post-intubation tracheal stenosis between 1994-1999.

Interval between ex-tubation and appearance of obstructive symptoms	Number of patient(%)
Immediately	15(46.8)
One month later	3(9.4)
Two months later	5(15.6)
Three months later	2(6.3)
Four to six months later	3(9.4)
Six to twelve months later	3(9.4)
More than one year	1(3.1)
Total	32(100)

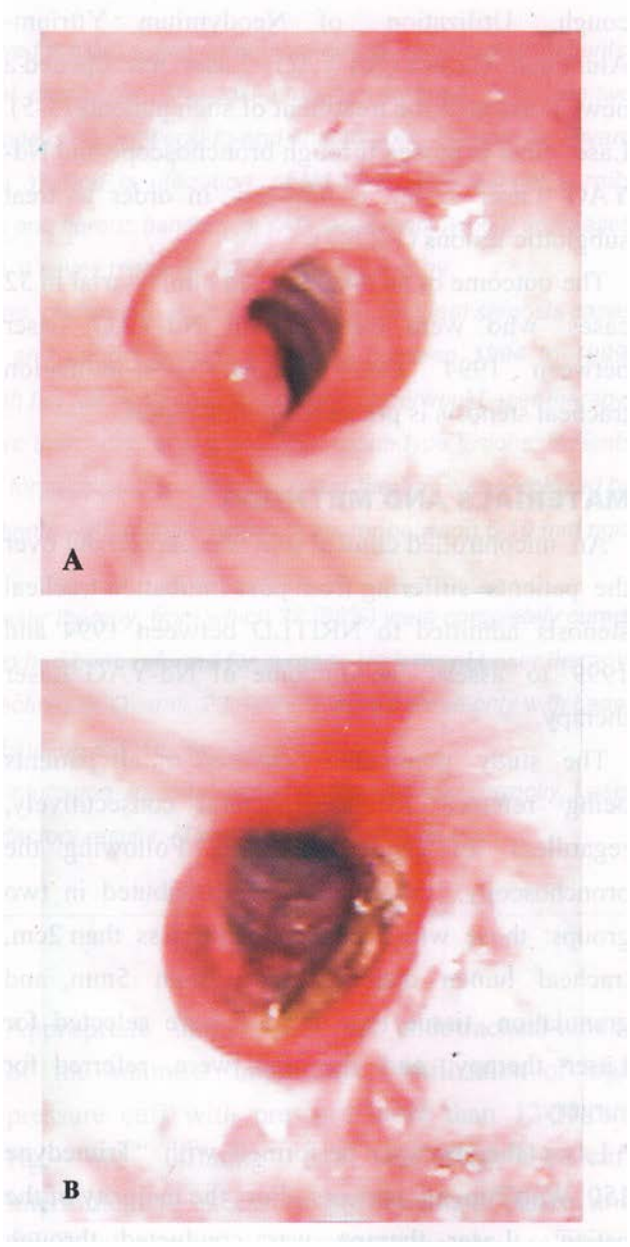

Fig 1. Post-Intubation lesion (a) after Laser-Therapy (B)

DISCUSSION

Some of the patients in our study were under long-term treatment by bronchodilators and different types of inhalers for dyspnea. Regarding patient's history, breathing pattern and spirometery findings (square off sign) (9,10), all of the patients with tracheal stenosis underwent bronchoscopy. Grillo is of the opinion that for patients with shortness of breath and history of surgery, a possible disorder in the main airway should be considered (10). The same consideration had been applied to our study. The patients with lumen lesions including web, granulation tissue and vocal cord lesions were introduced for Nd-YAG Laser therapy to remove the anatomic lesions. The majority of patients felt dramatically comfortable in breathing just during Laser therapy. Most of these patients were treated as outpatients without general anesthesia.

The attention to the history of patients with intractable dyspnea is of paramount importance. For instance, there are some reports showing that some female patients, who had cesarean section, return to the hospital with shortness of breath. Ablation of web in bronchoscopic Laser therapy was the best choice of treatment.

The complications of endotracheal Laser therapy usually last 10 days. Due to financial problems, control spirometery for all patients was not possible. Response to treatment was evaluated on the basis of being asymptomatic for a period of at least 8 months. Most of the patients were symptom-free during a 3-year follow up period. Response to treatment could be evaluated better with techniques like Maximal Voluntary Ventilation (MVV) (8,9).
This study demonstrates that 93% of patients, who had Laser therapy indications initially, showed positive response to treatment.

It suggests that Laser therapy is associated with an appropriate response to treatment and that patients who have the initial indications for Laser therapy do not require further surgical intervention.

It must be kept in mind that surgery is still an essential therapeutic approach for tracheal lesions, such as anatomic fibrosis and tracheomalacia. Therefore, it is concluded that using Laser therapy in conjunction with surgery and having the appropriate criteria for selecting patients for each therapeutic modality will result in the best treatment outcome.

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