ORIGINAL ARTICLE

Swiftlase Assisted CO2 Laser Ablation in the Treatment of Nasal Obstruction Due to Hypertrophy of the Inferior Turbinates

A Sani, FRCS, P Primuharsa, MS ORL-HNS, Department of Otorhinolaryngology, Faculty of Medicine, Hospital Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Kuala Lumpur

Summary

Hypertrophy of the inferior turbinates are the major cause of nasal obstruction. CO2 lasers have been used to reduce the size of the inferior turbinates over the last 20 years. However, the many techniques of delivery of the laser show that there is no one standard method reducing the size of the turbinates. We now describe how the laser can be applied directly to the turbinates using a handpiece with a special nasal tip, thus overcoming the disadvantages delivery via arthroscopic devices, microscopes and fibers. This technique is further enhanced by coupling it with Swiftlase which swirls the focused beam in a 3mm spot thus ablating tissue more quickly. This procedure is done under local anaesthesia. The ablation of the anterior third of the inferior turbinates effectively overcomes nasal obstruction.

This new method was compared to the more traditional submucus diathermy. 22 patients were subjected to laser treatment whilst 20 patients were subjected to diathermy. The outcome was evaluated subjectively by the patients themselves at 2 weeks, 3 months and 6 months. At the end of the study, the laser group reported a more significantly improved nasal airway (91% against 75%) and decreased rhinorrhea (72.7% against 35%) when compared to the diathermy group.

Key Words: CO2 laser, Inferior turbinates

Introduction

One of the commonest nasal symptoms of patients presenting to the ENT clinic is nasal obstruction. This is commonly caused by hypertrophy of the inferior turbinates. It is therefore not surprising that surgery to address this issue is amongst the commonest performed ENT operation. Before the 1980's, this would include trimming of the inferior turbinates (TIT) and submucus diathermy (SMD). Since the early 80's lasers have been applied to reduce the bulk of the inferior turbinates. Mittleman reported back in 1982 of his success[1]. Mladina and McCombe also reported success in the early 90's[2,3]. The idea of using the laser, which causes minimal bleeding on highly vascular turbinates is very attractive. Unfortunately the delivery of laser energy to such a small opening presents a major problem. The earliest description entails using a microscope[4] which was then followed by arthroscopic devices[5] and optical fibers[6] for the delivery of the laser energy to the turbinates. Using the microscope means the patient has to keep absolutely still. For some patients, this had to be performed under

general anaesthesia and this incurs the disadvantage of hospital stay and cost. Fiber makes delivery versatile but loses power at the target site and thus less efficient[5]. The optical fibers are disposable and this incurs cost.

In Hospital Universiti Kebangsaan Malaysia (HUKM), we have developed a technique to directly deliver the CO2 laser to the anterior portion of the hypertrophied inferior turbinates via a special nasal handpiece. The laser is coupled with the patented Swiftlase system of Sharplan (Sharplan Laser Industries Ltd, London) offers fast, efficient delivery of laser to ablate the inferior turbinates right down to the bony concha. This opens the nasal airway at its narrowest point, the so-called valve area of the nose[7]. SWIFTLASE is an accessory which rotates the laser beam in a 3 mm diameter effectively making the spot size of the laser bigger, thus ablating tissue faster. This procedure is performed under local anaesthesia as an outpatient procedure.

An initial study was performed comparing this new procedure to the more traditional submucus diathermy in HUKM between August 1998 to June 1999. This paper presents the result of this study.

Materials and Methods

All patients with nasal obstruction due to hypertrophy of the inferior turbinates, not responding to oral medication and topical nasal spray of six months duration were eligible for this study. Patients who had any form of nasal surgery before, gross nasal septal deviation, nasal polyps were excluded as these contribute to their nasal obstruction. Also excluded were children below 12 years of age who would not cooperate with this local procedure. The study period was from August 1998 to June 1999.

All patients were given a questionnaire to fill. They were asked to score their nasal obstruction and rhinorrhea on a linear scale of 0 to 3. Zero for absent, 1 mild, 2 moderate and 3 for severe. Informed consent was taken from the patient participating in this study.

The patients were randomly assigned to 2 groups. One group was subjected to submucus diathermy and the other had CO2 laser ablation of the inferior turbinates.

An independent evaluator who was blinded from the procedure, noted postoperative pain, bleeding, rhinorrhea and of course, nasal obstruction.

In both groups, the nasal mucus membrane was anaesthetised by inserting a one inch ribbon gauze soaked with a solution containing a dilution of 10% cocaine and 1:1000 adrenaline with equal amounts of normal saline. The ribbon gauze was left in the nose for 15 minutes.

In one group, submucosal diathermy was done. A lumbar puncture needle was introduced submucosally into the body of the inferior turbinates. While withdrawing the needle, a 3 Watt current was applied from a Valleylab SSE2 diathermy device. This was repeated 2 - 3 times in each nose.

The other group was subjected to CO2 laser ablation. The anterior third of the inferior turbinate was ablated to the bone as far posterior as the handpiece could go (Fig. 1). A Sharplan 1030 CO2 laser machine was used to deliver a 10-Watt focussed beam. A Swiftlase device (Fig. 2) swirls the beam in a 3mm spot. The rotating beam delivers the energy in an efficient way, making ablation faster. A special handpiece with a nasal tip (Fig 2) (model 1507) was used. It has an inbuilt suction port for the evacuation of smoke. All necessary safety precautions, especially the wearing of safety goggles, wet gauze over the face of the patients, were taken.

The laser procedure was performed by the first author while the submucus diathermy was undertaken by the second author.

The patients were evaluated by an independent ENT surgeon blinded from the procedure at 2 weeks, 3 months and 6 months.

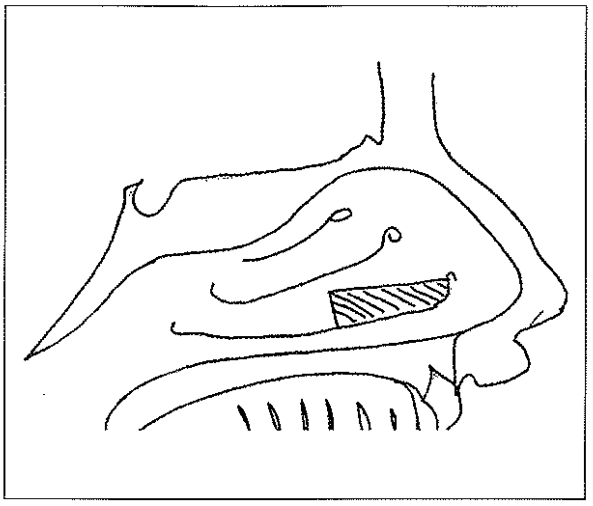

Fig. 1: Cross section of the lateral wall of the nose demonstrating the anterior part of inferior turbinate ablated by laser.

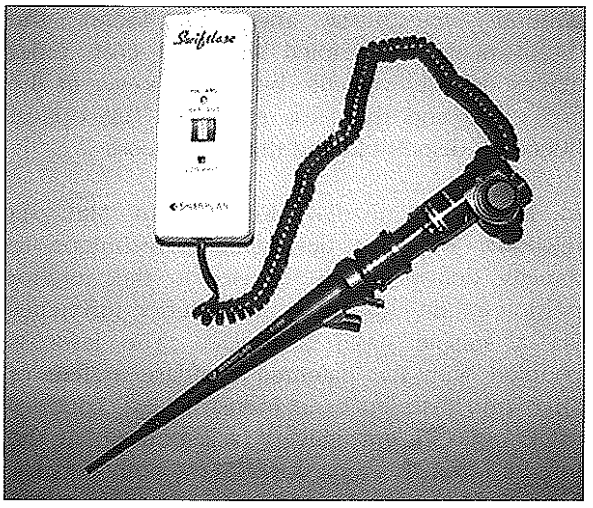

Fig. 2: Swiftlase device attached to a hand piece with the special nasal tip.

Results

There were 30 patients in each group. However only 22 patients in the laser group and 20 in the diathermy group were available for follow up studies at 2 weeks, 3 months and 6 months. 18 patients were lost in follow up.

Table I shows the age distribution of patients in both groups. Their age ranged from 11 to 44 years with a mean of 27 years. The age distribution in both groups was similar.

Table II and III shows the sex and racial distribution in both groups which were similar.

Table IV shows the improvement of nasal airway which was graded by the patients themselves. Any point decrease on the linear scale was taken as an improvement.

Intra operative pain is noted to be present when the patient complains of pain more than 3 times during the procedure. Table V shows 2 patients (9.1%) who underwent laser had intra operative pain compared with 16 patients (80%) who underwent diathermy. However the pain was tolerable and all patients could complete the procedure. Statistical analysis using the chi-squared test showed significant difference ($p<0.05$)

Table I
Age Distribution

	Number of Patients	
Age (years)	**Laser**	**Diathermy**
11-20	5 (22.7%)	5 (25.0%)
21-30	9 (40.9%)	9 (45.0%)
31-40	6 (27.3%)	4 (20.0%)
41-50	2 (9.1%)	2 (10.0%)
Total	22	20

Table II
Sex Distribution

	Laser		Diathermy	
	Male	Female	Male	Female
	10	12	10	10
Total	22		20	

Table III
Racial Distribution

	Number of Patients	
Race	**Laser**	**Diathermy**
Malay	15 (68.2%)	14 (70%)
Chinese	5 (22.7%)	4 (20%)
Indian	1 (4.5%)	2 (10%)
Others	1 (4.5%)	0
Total	22	20

Discussion

The inferior turbinates of the nose is a vascular organ made up of erectile tissue. Chronic and repeated stimulation causes it to hypertrophy resulting in nasal obstruction. Medical treatment by way of antihistamines and nasal steroids are used with success. However in a number of cases the obstruction is only temporarily or not relieved at all. In such cases surgery is done to reduce the size of the turbinates.

Table IV
Improvement in Nasal Obstruction after Laser Vaporization and Submucosal Diathermy (SMD)

	Laser (n=22)			SMD (n=20)		
	2 weeks	**3 weeks**	**6 months**	**2 weeks**	**3 months**	**6 months**
Improved	19 (86.4%)	20 (91.0%)	20 (91.0%)	14 (70%)	15 (75%)	15 (75%)
No improvement	3 (13.6%)	2 (9.1%)	2 (9.1%)	6 (30%)	5 (25%)	5 (25%)

Table V
Complaints of Intraoperative Pain

	Laser (n=22)	SMD (n=20)
Pain	2 (9.1%)	16 (80%)
No pain	20 (90.9%)	4 (20%)

Subjective improvement of rhinorrhea was studied and Table VI showed more than half of the patients who underwent laser treatment had this benefit when compared to less than 50% in the diathermy group. Again statistical analysis using the chi-squared test showed significant difference ($p<0.05$).

Two of the more popular methods are submucus diathermy (SMD) and trimming of the inferior turbinates (TIT). TIT requires general anaesthesia has a reported morbidity of severe postoperative epistaxis of 10%[8]. With SMD the amount of tissue shrunk is limited. Therefore with the introduction of lasers it seems attractive to perform almost bloodless surgery on such a vascular tissue. Indeed there are now a great variety of CO2 laser techniques described in the literature. Selkin uses the CO2 laser to resect hypertrophied mucosa of the turbinate in a line, whereas Elwani vaporize the mucosa of the anterior one third of the turbinate[9,10]. Fukutake repeatedly vaporize the mucosa once a week for 5 weeks[11].

Table VI
Improvement in Rhinorrhea after Laser Vaporization and Submucosal Diathermy (SMD)

	Laser (n=22)			SMD (n=20)		
	2 weeks	**3 weeks**	**6 months**	**2 weeks**	**3 months**	**6 months**
Improved	15 (68.2%)	16 (72.7%)	16 (72.7%)	8 (40%)	9 (45%)	7 (35%)
No improvement	7 (31.8%)	6 (27.3%)	6 (27.3%)	12 (60%)	11 (55%)	13 (65%)

We now present our method which allows direct delivery of the laser to the inferior turbinates. The hand piece with a nasal tip effectively shields and protect the septum of the nose from any accidental laser injury. Coupled with Swiftlase, which rotates the focused beam randomly in a 3mm spot effectively and efficiently ablates all turbinate tissue within reach of the beam. This usually means the anterior third of the inferior turbinate including the underlying bone if necessary. More importantly, it ablates tissue at the valve area, which is the narrowest part of the nose.

To demonstrate that it is effective a study was undertaken to compare the benefits of this laser procedure with SMD in patients with hypertrophy of the inferior turbinates. The 2 groups of patients were similar in age, race and sex to reduce epidemiological bias.

At 2 weeks, 3 months and 6 months after the procedure, the patients in the laser group report significant subjective improvement in nasal obstruction when compared with the diathermy group. This is not surprising because there is more tissue ablated with the laser when compared with amount of tissue shrunk by diathermy. Moreover, Elwani found that turbinate tissue that has been ablated is replaced by fibrous tissue which anchors the new mucosa to the conchal bone making it less liable to engorgement[10]. With such an aggressive technique used in this study, ablating as much turbinate tissue allowed by access of the nasal tip, better long term results is expected. At the same time careful follow up does not show any excessive crusting or development of atrophic rhinitis. This is probably due to the high humidity in the air in Malaysia when compared to other temperate countries. The nose has a large surface area and ablating part of the inferior turbinate does not adversely affect the physiologic functions of the nose.

There was significantly less intra operative and post operative pain with the laser when compared with diathermy. This is an added bonus to the laser procedure. McCombe explained that the pain experienced with the diathermy is due to the current spreading beyond the turbinate[3]. Laser energy on the other hand does not spread at all.

Significant improvement in rhinorrhea was noted amongst patients in the laser group. Inouye also had similar results[12]. This improvement is explained by Fukutake by the creation of scar tissue which does not secrete and hence decreasing rhinorrhea[11]. It is also possible that the surface mucus secreting glands are decreased in number and function by laser vaporization[13].

There are some disadvantages in this technique. The laser and its accessories are expensive when compared to the diathermy machine. Also, one has to take elaborate but necessary precautions to avoid any accidental laser injuries. However with more and more centers acquiring this device and more doctors being trained in its use, the superior benefits will overshadow these drawbacks.

Conclusion

A new technique of direct delivery of laser energy to the inferior turbinates, ablating tissue faster and more efficiently is described. This study shows superior results in relieving nasal obstruction and rhinorrhea amongst patients with hypertrophy of the inferior turbinates.

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