ORIGINAL ARTICLE

Refractory chronic rhinitis: long-term outcomes after LASER Nd: YAG treatment

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ABSTRACT

Study hypothesis and objective: To evaluate the subjective efficacy and tolerability of LASER Nd:YAG photocoagulation of the inferior turbinates used to relieve nasal obstruction in patients with chronic rhinitis.
Patients and methods: Of 136 patients treated between 1996 and 2000, 106 were evaluated retrospectively. Mean energy delivered per turbinate varied over time from 1123 to 383 joules.
Results: Nasal obstruction was due to turbinate hypertrophy in 93 patients (including 9 with and 84 without rhonchopathy), allergic rhinitis (n=9), or chronic nonallergic rhinitis with eosinophilia syndrome (n=4). Mean follow-up was 44.2±16.8 months. Laser Nd:YAG photocoagulation was effective in 63.2% of cases. An improvement in nasal obstruction was noted initially in 90.6% of patients and persisted for longer than 1 year in 80.2% of cases. Nasal obstruction worsened in 2 patients. The operative conditions were deemed satisfactory by 91.5% of patients and the postoperative period uneventful by 54.7% of patients.
Conclusion: LASER Nd: YAG photocoagulation of the inferior turbinates is effective and well tolerated in the long term when used to treat patients with chronic rhinitis causing nasal obstruction that is unresponsive to pharmacotherapy.

(Fr ORL - 2006 ; 90 : 217-224)

(This work was presented in 2003 at the EAACI, Paris, and in 2003 at the 110th French ORL and Head&Neck Surgery Meeting)

Keywords: Chronic rhinitis, Nasal blockage, Photocoagulation, LASER Nd: YAG.

Submitted for publication: November 2004
Accepted for publication: March 2006
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INTRODUCTION

Nasal obstruction is the symptom most commonly reported by patients with chronic rhinitis [1]. The cause is hypertrophy of the mucosa lining the inferior turbinates [2]. Topical glucocorticoid therapy and antihistamine agents are used for the first-line treatment of chronic rhinitis [3]. When these medications fail to relieve the nasal blockage, surgery to reduce the size of the turbinates may be considered.

Laser turbinate surgery was developed in the early 1980s and produces good functional results with a low morbidity rate [4]. Neodymium YAG (Nd:YAG) laser is widely used for turbinate surgery, because its 1064-nm wavelength ensures low absorption and marked tissue penetration around the impact site. The laser produces coagulation over a distance that can reach or exceed 10 mm from the impact site [5]. To our knowledge, the efficacy of Nd:YAG laser photocoagulation of the inferior turbinates has not been evaluated in studies with follow-ups longer than 2 years and sample sizes larger than 70 patients [6-9]. Therefore, we investigated the functional outcomes after Nd:YAG laser photocoagulation of the inferior turbinates in a vast cohort followed up for longer than 3 years.

The objective of this study was to evaluate the long-term subjective efficacy and tolerability of Nd:YAG laser photocoagulation of the inferior turbinates in 106 patients with chronic rhinitis unresponsive to medical therapy.

PATIENTS AND METHODS

Population

From January 1996 to December 2000, 136 patients underwent inferior turbinate reduction using Nd:YAG laser photocoagulation. Among them, 30 were lost to follow-up and 106 were included in the study. Their medical charts were reviewed retrospectively. The etiological diagnosis relied on the medical history, physical evaluation, and selected investigations (multiallergen screening test [Phadiatop®] and specific IgE assays in patients with suspected allergic disease; and nasal cytology in those with suspected NARES).

Data collection

The following data were abstracted from the medical records: characteristics and causes of the nasal obstruction; treatments used before surgery; and effect of surgery on nasal obstruction, tolerance of the procedure, constraints perceived by the patient, and complications recorded by the physician 1 and 4 months after surgery. Data on long-term outcomes were collected by a telephone interview (Table I) conducted by an otorhinolaryngology resident who was not otherwise involved in the study. The patient was asked about the long-term efficacy of laser surgery on nasal obstruction and the treatments used since the procedure.

Nasal obstruction was evaluated before surgery and 1 and 4 months after surgery by three physicians. A three-level semi-analog scale was used, in which 1 indicated mild obstruction, 2 moderate obstruction, and 3 severe obstruction. Moderate to severe obstruc-

Table I: Questionnaire used for the standardized telephone interview

How long did the benefits from the laser procedure last?	Is your nose blocked today?	If your nose is blocked, is the blockage	Did you have a second laser session for your nasal blockage?
Less than 6 months 6 months to 1 year More than 1 year	Yes No	Severe Moderate Mild	Yes No

Did you have another procedure other than a laser session for your nasal blockage?	If the blockage still bothers you, would you be willing to have another laser session?	If not, why?
Yes No	Yes No	Because laser treatment does not work Because laser treatment is burdensome

tion was defined as adversely affecting breathing and quality of life.

Surgical procedure

Nd:YAG laser photocoagulation was used as the first-line method for lower turbinate reduction, except in patients requiring septoplasty, who underwent endonasal turbinectomy during the septoplasty procedure. The indication for Nd:YAG laser therapy was determined by three of us during the preoperative evaluation. The procedure was performed in the operating room by one of these three physicians using a Laserscope Orion, Laser System (San Jose, CA, USA) with Endostat, quartz optic fibers (Laserscope, San Jose, CA, USA) measuring 0.6 mm in diameter. The patient was supine on the operating table. Laser-specific eyewear having an optical density of 5 was used by all the individuals in the operating room. The patient was examined to check the absence of cardiologic contraindications and allergy. A cotton pledget soaked in 5% lidocaine with naphazoline (Xylocaïne,, one bottle) and 0.005% oxymetazoline (Aturgyl,, one bottle) was placed in the nasal cavities. After 10 minutes, the pledget was removed and an optic fiber was introduced into the nasal cavity using a rigid 25° endoscope. During the first 2 years of the study period (1996 and 1997), a no-contact multiple-hit photocoagulation technique was used. Subsequently, delivery was into the submucosal tissue: the optic fiber was introduced into the inferior turbinate submucosa over about 1.5 cm then withdrawn in the posterior-to-anterior direction with continuous laser delivery at a mean power of 10 Watts. This process was repeated over the medial aspect and lower edge of the turbinate. Figure 1 reports the energy delivered to each nasal cavity according to the calendar year of treatment. The nose was not packed after the procedure. The patient returned home within the first hour after the procedure with a prescription for saline nasal irrigation daily for 1 month. Postoperative results were evaluated 1 and 4 months after the procedure.

Statistical analysis

Improvements in nasal obstruction, tolerability of the procedure, and immediate postoperative events were compared in patients treated before and after 1997, using chi-square tests, with Yates' correction. To compare improvements in nasal obstruction across chronic rhinitis subgroups, chi-square tests were performed, with Yates' correction where appropriate. In all statistical tests, P values smaller than 0.05 were considered significant.

RESULTS

Study population (Table II)

The cohort comprised 106 patients, 72 men and 34 women, with a mean age of 42.0±17.3 years (range, 12-85 years) and a diagnosis of nasal obstruction due

Figure 1: Energy delivered by calendar year.

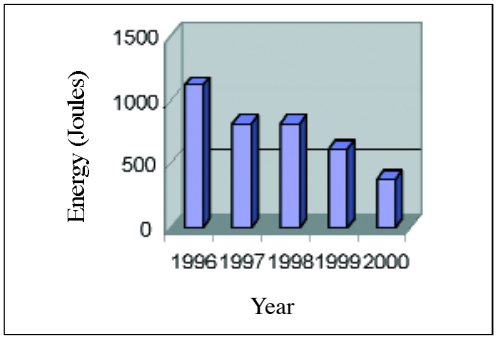


Table II: Characteristics of the nasal obstruction in the 106 study patients

Severity of nasal obstruction		Symptom duration		Precipitating factor		Preoperative medical treatment		Cause of nasal obstruction	
Mild	14.1 %	< 2 years	15.1 %	Yes	11.3 %	Yes	93.4 %	Allergy	8.5 %
Moderate	47.2 %	2 to 10 years	45.3 %					TH without rhonchopathy	79.2 %
Severe	38.7 %	2 to 10 years	45.3 %	No	88.7 %	No	6.6 %	TH with rhonchopathy	8.5 %
								NARES	3.8 %

TH: Turbinate hypertrophy; NARES: Chronic nonallergic rhinitis with eosinophilia syndrome

Table III: Short-term (IIIa) and long-term (IIIb) effects of Nd: YAG laser photocoagulation in terms of relief from nasal obstruction.

Tableau IIIa

Short-term relief from nasal obstruction		Duration of initial relief from nasal obstruction (n=96)	
Complete	65.1 %	< 1 month	73.0 %
Partial	25.5 %	1-3 months	20.8 %
No	9.4 %	> 3 months	6.2 %

Tableau IIIb

Duration of relief from nasal obstruction (n=96)		Nasal obstruction on the day of the telephone interview		Severity of nasal obstruction on the day of the telephone interview (n=39)	
< 6 months	8.3 %	Yes	36.8 %	Mild	71.8 %
6months-1year	11.5 %			Moderate	23.1 %
> 1 year	80.2 %	No	63.2 %	Severe	5.1 %

Table IV: Treatments for nasal obstruction after Nd:YAG laser turbinate reduction.

Type of treatment (n=14)		Willing to undergo further Nd: YAG laser treatment		Reasons for being unwilling to receive further Nd:YAG laser treatment (n=26)	
LASER Nd: YAG	64.3 %	Yes	75.5 %	Burdensome	61.5 %
Other turbinate reduction procedures	35.7 %	No	24.5 %	Ineffective	38.5 %

to chronic rhinitis without significant septal deviation. Of the 106 patients, 99 failed to experience sustained improvement during treatment with topical corticosteroid therapy for 1 month or longer, or systemic corticosteroid therapy for brief periods, combined with an antihistamine or anticholinergic agent as appropriate. Information on medical treatment was not available for the 7 remaining patients, who came from abroad for treatment. Nasal obstruction was due to turbinate hypertrophy in 93 patients, including 9 with and 84 without rhonchopathy; allergic rhinitis in 9 patients; and nonallergic rhinitis with eosinophilia syndrome (NARES) in 4 patients.

Efficacy (Tables IIIa, IIIb, and IV)

Mean follow-up was 44.2±16.8 months (range, 15-72 months). Four months after the procedure, complete relief from nasal obstruction was reported by 69 (65%) patients, partial relief by 27 (25.6%), and worsening by 2 (1.8%). Of these last 2 patients, 1 experienced early development of septoturbinal adhesions and the other later development of crusty rhinitis. Improvements in nasal obstruction were not significantly different between the patients treated during the first 2 years 1997 (no-contact technique) and those treated after 1997 (submucosal technique). Neither was any significant difference found across rhinitis subgroups. However, a trend was noted toward a higher rate of sustained relief in patients with turbinate hypertrophy; in this subgroup, 63.2% of patients reported no nasal obstruction on the day of the interview, compared to 50% of patients with NARES and 44.4% of those with allergic rhinitis.

Relief from nasal obstruction occurred within 3 months in 93.8% of patients; relief occurred within 2 weeks in 40.5% of patients (data not shown). Among the improved patients, 80.2% reported that the impro-

Table V: Tolerability of Nd:YAG laser for inferior turbinate reduction.

Tolerability of the procedure		Causes of poor tolerability (n=9)		Immediate post-operative period		Burdens (n=48)		Duration of post-operative nasal irrigation	
Good	91.5 %	Topical anesthesia	66.6 %	Uneventful	54.7 %	Nasal irrigations	56.2 %	< 15 days	32.0 %
		Pain	33.3 %	Minimal		Crusts	41.6 %		
Poor	8.5 %	Anxiety	11.1 %	burdens	30.2 %	Bloody		15days-1months	48.1 %
				Major		discharge	20.1 %		
				burdens	15.1 %	Pain	2.1 %	> 1 month	19.9 %

vement lasted longer than 1 year, including 2 patients who said they were dissatisfied with the procedure (data not shown). On the day of the telephone interview, 36.8% of patients reported some nasal obstruction, but among them 94.9% described the obstruction as mild or moderate.

A second turbinate reduction procedure was performed in 14 (13.2%) patients. In 9 of these 14 patients, the second procedure consisted in Nd:YAG photocoagulation, which induced improvements in 7 (77.8%) patients (data not shown).

Tolerability (Table V)

Among the 106 patients, 91.5% were satisfied with the conditions of the procedure. Furthermore, the satisfaction rate increased steadily over the years (Figure 2). Tolerability was not significantly different between the patients treated before and after 1997. Of the 9 patients who reported poor tolerability, 6 complained of the topical anesthesia and 3 of postoperative pain.

No serious adverse events were reported. Of the 48 patients who reported postoperative discomfort, 20 (41.6%) ascribed the discomfort to nasal crusting, 10 (20.1%) to a bloody discharge, and 27 (56.2%) to the nasal irrigations. However, nasal irrigations were performed for less than 1 month in 80.1% of patients. In addition, the number of patients reporting nasal crusting and a bloody discharge decreased steadily over the study period (Figure 3).

The postoperative period was considered uneventful by 42.8% of patients treated before 1997 and 54.2% of those treated after 1997. The difference was not statistically significant.

Figure 2: Satisfaction with the operative conditions by calendar year.

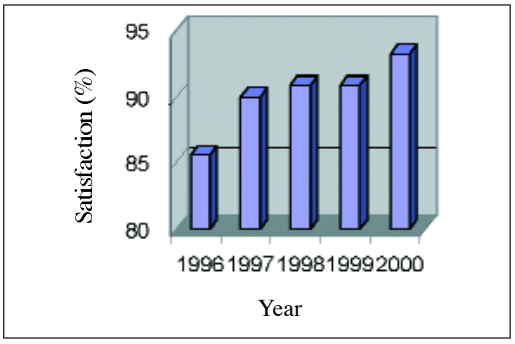
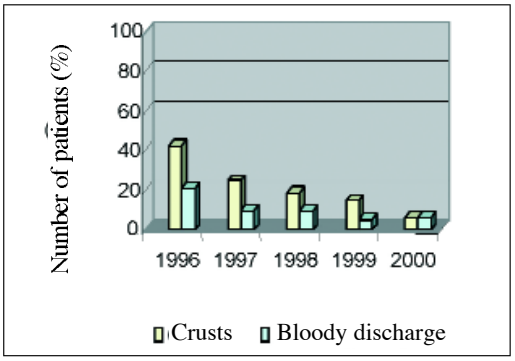


Figure 3: Adverse events in the early postoperative period by calendar year.



DISCUSSION

In this study, Nd:YAG laser photocoagulation was effective in 63.2% of patients with chronic rhinitis unresponsive to medical therapy, after a mean follow-up of 44.2±16.8 months.

Many laser types have been used for inferior turbinate reduction, including argon, KTP, diode, CO2, Ho: YAG, and Nd:YAG. The physical characteristics of Nd:YAG laser ensure coagulation to a depth of 5 mm, which is the mean thickness of the hypertrophied turbinate mucosa [10]. In addition, Nd:YAG laser spares the ciliated respiratory epithelium, which plays

a major functional role in draining the nasal mucosa [6, 11].

The mean energy dose delivered to each turbinate decreased over the study period, from 1123 Joules in 1996 to 383 Joules in 2000. This decrease is ascribable to a technical modification that was introduced gradually, starting in 1997: the laser beam was delivered using a no-contact technique at the beginning of the study period and submucosally later on. Among earlier studies of Nd:YAG photocoagulation [6-9], all but one [6] used contact photocoagulation without submucosal penetration, with a mean power of 5 to 20 Watts, compared to 10 Watts in our study. We switched to the submucosal technique primarily to spare the superficial layers while effectively coagulating the hypertrophied submucosa. In addition, although neither the improvement in nasal obstruction nor the tolerability of the procedure differed significantly between the two techniques, patient satisfaction regarding operative conditions improved steadily over the years. The factors that contributed to this improvement may include greater surgeon experience; the switch to submucosal delivery, which decreased the amount of energy required, and therefore diminished the surgery-related pain; and a reduction in postoperative constraints. These factors probably explain the trend toward a higher rate of uneventful postoperative course after submucosal delivery (54.2%) than after no-contact delivery (42.8%).

We assessed nasal obstruction as perceived by the patients, in keeping with many previous studies [8, 12-15]. The extent to which rhinomanometry measurements reflect patient-reported symptoms remains controversial. In an earlier study comparing subjective and objective evaluations of nasal obstruction after laser turbinate reduction surgery, the correlation was only 58% [13]. In addition, respiratory comfort can improve in the absence of changes in nasal resistance [16].

In our study, improvements in nasal obstruction lasted more than 1 year in 80.2% of cases, which compares favorably with earlier reports [6-9]. Severe nasal obstruction was reported by 38.7% of patients preoperatively compared to only 5.1% on the day of the interview. Thus, nasal obstruction persisting after Nd:YAG laser therapy was minimal or moderate in the vast majority of cases.

The 2 patients who reported worsening nasal obstruction after the procedure were treated in 1996 using the no-contact technique and more than 1000 Joules to each turbinate. Adhesions between the inferior turbinate and the septum developed in 1 of these patients and incapacitating crusty rhinitis in the other. Comparisons of efficacy across rhinitis subgroups failed to detect statistically significant differences. A trend toward longer lasting relief from nasal obstruction was noted in the turbinate hypertrophy subgroup compared to the other subgroups, in keeping with recent studies [17-18]. Thus, the efficacy of Nd:YAG therapy may be independent from the cause of chronic rhinitis, suggesting a potential for reducing medication requirements [13].

Compared to other laser types, Nd:YAG laser provides similar efficacy [2, 8, 19]. The advantage of surgery (turbinectomy or turbinoplasty) over laser therapy consists in a high rate of long-term relief from nasal obstruction [20-22]. However, surgery is usually performed under general anesthesia and requires packing of the nasal cavities. In addition, postoperative pain and the risk of bleeding and atrophic rhinitis associated with turbinectomy and turbinoplasty have led to the suggestion that these techniques may be best reserved for patients who fail to respond to other turbinate reduction procedures [23].

Although efficacy and tolerance data suggest that radiofrequency thermotherapy may hold promise as an alternative to laser photocoagulation [24], the studies published to date had follow-up durations no longer than 20 months [25] or included fewer than 35 patients [26]. In addition, the practical modalities for radiofrequency thermotherapy (optimal energy dose, number of punctures, and number of sessions) remain ill-defined. Further studies are needed to ensure the reproducibility of results achieved using radiofrequency thermotherapy.

CONCLUSION

In conclusion, Nd:YAG laser photocoagulation for inferior turbinate reduction is a simple and safe method that ensures long-term relief from nasal obstruction in patients with chronic rhinitis unresponsive to medical treatment.

REFERENCES

1. McCaffrey TV, Kern EB. Clinical evaluation of nasal obstruction. A study of 1,000 patients. Arch Otolaryngol. 1979; 105: 542-545.

2. Inouye T, Tanabe T, Nakanoboh M, Ogura M. Laser surgery for allergic and hypertrophic rhinitis. Ann Otol Rhinol Laryngol Suppl. 1999; 180: 3-19.

3. van Cauwenberge P, Bachert C, Passalacqua G et al. Consensus statement on the treatment of allergic rhinitis. European Academy of Allergology and Clinical Immunology. Allergy 2000; 55: 116-134.

4. Lenz H. [8 years' laser surgery of the inferior turbinates in vasomotor rhinopathy in the form of laser strip carbonization]. HNO 1985; 33: 422-425.

5. Janda P, Sroka R, Baumgartner R, Grevers G, Leunig A. Laser treatment of hyperplastic inferior nasal turbinates: a review. Lasers Surg Med. 2001; 28: 404-413.

6 Lippert BM, Werner JA. [Nd:YAG laser light-induced reduction of the nasal turbinates]. Laryngorhinootologie 1996; 75: 523-528.

7. Galletta A, Amato G. [Photocoagulation of the hypertrophic lower turbinates using ND:YAG laser: functional results]. Acta Otorhinolaryngol Ital. 1997; 17: 329-338.

8. DeRowe A, Landsberg R, Leonov Y, Katzir A, Ophir D. Subjective comparison of Nd:YAG, diode, and CO2 lasers for endoscopically guided inferior turbinate reduction surgery. Am J Rhinol. 1998; 12: 209-212.

9. Olthoff A, Martin A, Liebmann F. [Nd:YAG laser treatment of the lower turbinates with contact in hyperreflexic and allergic rhinopathy]. Laryngorhinootologie 1999; 78: 240-243.

10. Goldsher M, Joachims HZ, Golz A et al. Nd:YAG laser turbinate surgery animal experimental study: preliminary report. Laryngoscope 1995; 105: 319-321.

11. Elwany S, Harrison R. Inferior turbinectomy: comparison of four techniques. J Laryngol Otol. 1990; 104: 206-209.

12. Serrano E, Percodani J, Woisard V et al. [Efficacy of partial inferior turbinectomy in the treatment of nasal obstruction. Retrospective study apropos of 71 patients]. Ann Otolaryngol Chir Cervicofac. 1996; 113: 379-383.

13. Lippert BM, Werner JA. Long-term results after laser turbinectomy. Lasers Surg Med. 1998; 22: 126-134.

14. Bergler W, Riedel F, Gotte K, Hormann K. Argon plasma coagulation for inferior turbinate reduction. Ann Otol Rhinol Laryngol. 2000; 109: 839-843.

15. Serrano E, Percodani J, Yardeni E, Lombard L, Laffitte F, Pessey JJ. The holmium:YAG laser for treatment of inferior turbinate hypertrophy. Rhinology 1998; 36: 77-80.

16. Cole P. Rhinomanometry 1988: practice and trends. Laryngoscope 1989; 99: 311-315.

17. Janda P, Sroka R, Tauber S, Baumgartner R, Grevers G, Leunig A. Diode laser treatment of hyperplastic inferior nasal turbinates. Lasers Surg Med. 2000; 27: 129-139.

18. Leunig A, Janda P, Sroka R, Baumgartner R, Grevers G. Ho:YAG laser treatment of hyperplastic inferior nasal turbinates. Laryngoscope 1999; 109: 1690-1695.

19. Ferri E, Armato E, Cavaleri S, Capuzzo P, Ianniello F. Argon plasma surgery for treatment of inferior turbinate hypertrophy: a long-term follow-up in 157 patients. ORL J Otorhinolaryngol Relat Spec. 2003; 65: 206-210.

20. Passali D, Passali FM, Damiani V, Passali GC, Bellussi L. Treatment of inferior turbinate hypertrophy: a randomized clinical trial. Ann Otol Rhinol Laryngol. 2003; 112: 683-688.

21. Fradis M, Golz A, Danino J et al. Inferior turbinectomy versus submucosal diathermy for inferior turbinate hypertrophy. Ann Otol Rhinol Laryngol. 2000; 109: 1040-1045.

22. Faulcon P, Amanou L, Bonfils P. [Treatment of nasal obstruction with subtotal inferior turbinectomy in chronic rhinitis: a retrospective study on 50 patients]. Ann Otolaryngol Chir Cervicofac. 1998; 115: 228-233.

23. Oluwole M, Mills RP. An audit of the early complications of turbinectomy. Ann R Coll Surg Engl. 1994; 76: 339-341.

24. Coste A, Yona L, Blumen M, et al. Radiofrequency is a safe and effective treatment of turbinate hypertrophy. Laryngoscope 2001; 111: 894-899.

25. Seeger J, Zenev E, Gundlach P, Stein T, Muller G. Bipolar radiofrequency-induced thermotherapy of turbinate hypertrophy: pilot study and 20 months' follow-up. Laryngoscope 2003; 113: 130-135.

26. Nease CJ, Krempl GA. Radiofrequency treatment of turbinate hypertrophy: a randomized, blinded, placebo-controlled clinical trial. Otolaryngol Head Neck Surg. 2004; 130: 291-299.