SURGICAL TREATMENT OF INFERIOR TURBINATE HYPERTROPHY WITH ARGON PLASMA: A LONG-TERM FOLLOW-UP IN 157 PATIENTS

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ABSTRACT

Surgical treatment of the inferior turbinate in patients with chronic hypertrophic rhinitis that does not respond to medical treatment is a well established procedure. CO₂ laser, YAG laser, KTP laser, conventional electrocautery, cryotherapy, chemosurgery and turbinectomy or submucosal turbinectomy have been performed for the removal of nasal obstruction. Argon Plasma Coagulation (APC) is a new, innovative technique in Otorhinolaryngology which is based on high-frequency electrocoagulation with an argon-gas source. The shorter surgical times, the absence of hemorrhagic complications and, in rhinosurgery, not requiring any kind of nasal packing are remarkable. Between March and November 2000, a group of 157 patients with symptoms of nasal obstruction due to hypertrophic inferior turbinates were treated using APC, at the Otorhinolaryngology Surgical Department of the Hospital of Dolo (Venice). The follow-up period was 24 months. Rhinomanometry was performed to objectively measure the nasal obstruction and to verify the postoperative improvement. The Student t-test was used for statistical data. After 24 months, 87% (p<0.001) of patients reported to have a better nasal airflow than before the operation. None of the patients needed a nasal packing after APC surgery. We review and discuss the indication, advantages, complications, controversies and long-term results of the treatment with APC in rhinosurgery.

KEY WORDS: Argon plasma coagulation. Rhinosurgery. Treatment of hypertrophic turbinate.
INTRODUCTION

Surgical treatment of the inferior turbinate in patients with chronic hypertrophic rhinitis who do not respond to medical treatment is a well-established practice. CO2 laser, YAG laser, conventional electrocauterization, cryotherapy, and turbinectomy or submucous turbinectomy have all been used to reduce nasal obstruction.

Recently, a new kind of electrosurgery, argon plasma coagulation (APC), that had been successfully used on gastrointestinal lesions by means of endoscopy, was introduced to the field of otorhinolaryngology. The equipment consists of an argon gas liberator system connected to a high frequency electrical generator. The argon, ionized by the monopolar current, acts on the surface of the area that we want to coagulate with a penetration depth of not more than 3mm. This type of action is particularly beneficial at the level of the parenchyma and highly vascularized mucosal surfaces. Its most effective applications are the endonasal (turbinate surgery, epistaxis, hemorrhagic telangiectasia), the endolaryngeal (laryngotracheal papilloma, laryngeal stenosis, granulomas) and those related to the oropharynx (benign neoplasias, uvulopalatoplasties).

Compared with other mechanical methods used for the reduction of the inferior turbinates, APC causes less bleeding and does not require nasal packing. Furthermore, the thermic effects are easily controllable as they do not depend on the distance between applicator and tissue and only cause a superficial devitalization of 3mm in depth. APC reduces mucosal inflammation through a mild submucous fibrosis.

In this study we evaluated our experience, analyzing the long term results of APC in the treatment of chronic hypertrophic rhinitis.

MATERIAL AND METHODS

Equipment and principles of the APC technique

The equipment needed for APC is an automatically regulated reserve unit of argon gas, a high frequency electrical generator, and a tube of rigid or flexible teflon with a ceramic tip. The physical principle of APC is quite simple: the combination of the liberated argon with the high frequency current causes the ionization of the gas and its emission through the distal part of the tube. The electrode that represents one of the poles of the source of high frequency voltage is placed here. The other pole is connected to the patient as it is usually done in electrosurgery.

In the presence of an electrical field of 500 V/mm, the argon becomes ionized and forms argon plasma with which a high frequency current is created and subsequently applied to the tissue that we want to treat.

The argon plasma directs itself towards the localizations where electrical activity is greatest, thus it automatically leaves those areas which are already coagulated (which show a high level of electrical resistance and a low level of conductivity), to reach the hemorrhagic areas (with a low electrical resistance and high conductivity). The effect of coagulation is, then, homogenous, regular and self-restricting. Being an inert gas, argon does not evaporate or carbonize tissues.

PATIENTS

In this study we included 157 patients with symptoms of nasal obstruction due to inferior turbinate hypertrophy. We treated 84 men and 73 women, with an average age of 48 (range: 19-77). In 136 patients (86.6%) the hypertrophy was bilateral and in 21 (13.4%) unilateral. The main causes of the increase in size of the inferior turbinate were allergic rhinitis in 37 cases, vasomotor in 79, and chronic abuse of nasal decongestant in 41 cases. In all of them no response to conservative pharmacological treatment with corticosteroids and antihistamines was seen.

We excluded from the study all cases of nasal obstruction due to or significantly worsened by a deviation of the nasal septum. Similarly, cases of turbinate hypertrophy in allergic patients who had not been previously treated and cases of turbinate hypertrophy due to an increase in the size of the bony part of the turbinate were not included in the study.

We examined all the patients endoscopically to evaluate the degree of their hypertrophy. To quantify the degree of nasal obstruction we carried out a rhinomanometry before surgery and at 3, 6, 12 and 24 months after surgery. The rhinomanometric study is also useful for the exclusion of cases in which the hypertrophy of the turbinate is due to its bony
component. After a first measurement we used a spray with naphazoline (1:1000) and after 15 minutes we carried out a second rhinomanometry. If the air flow didn’t improve after the administration of the naphazoline, we asked for a CT to evaluate the bony nasal structures.

For the statistical analysis of the information obtained from the pre- and post-operative rhinomanometry we used the Student test of t, determining statistical significance at p < 0.01.

We examined all patients on the first and fifth day, first and fourth week, third and sixth month, and first and second year after surgery and we gave them a standardized questionnaire in which the following questions were included: 1) Has your condition improved after surgery?, 2) For how long did this improvement last?, 3) Have you experienced any post-surgical complications?, 4) Having had this procedure and experienced its results, would you undergo the same operation again?

Surgical technique

We anesthetized the nasal mucosa of the patient with lidocaine 2% and we infiltrated mepivacaine 2% with epinephrine at 1/200,000. In anxious patients we used intravenous analgesia and sedatives. For the treatment we used a rigid applicator with a ceramic tip and an opening for the flow of the gas to one side of the tip. We programmed the generator at between 40 W and 60 W and the argon flow at 1.2 l/min. We didn’t take any special safety precautions (glasses etc).

To decrease the size of the turbinate we applied APC from the third to the inferior half along the entire length of the turbinate. To do this we took less than 5 minutes per nasal fossa. To avoid damage to the septal mucosa we protected it with a small silicone strip. No patient required nasal packing after surgery.

RESULTS

The incidence of complications was very low; only 2 out of 157 patients treated in our study (1.2%) suffered post-operative bleeding. This was between the seventh and the ninth day postoperatively and was stopped easily with conservative treatment. There was one case of synechia (0.6%) from the septum to the surface of the inferior turbinate which was successfully thermocoagulated two weeks after surgery.

Analysis of the results of the post-operative questionnaire showed that APC surgery is followed by a worsening of nasal respiration during the first week, which can be explained by the development of reactive oedema. After the first week, however, the reduction of the oedema and the healing process produced an improvement of the symptoms. After three months, 85.3% of patients referred an improvement in their nasal air flow, in comparison with their pre-operative state. 12 and 24 months after surgery, 86.6% and 87% of patients, respectively, reported a marked improvement which confirms the rhinomanometric data (Figure 1).

Fourteen patients (8.9%) claimed not to be satisfied with the results six months after surgery. The reasons were:
- Poor use of the equipment (use of a reduced flow, lack of experience of the surgeon)
- Lack of cooperation from the patient
- Concomitant psycho-functional pathology

The rhinomanometry 3, 6, 12 and 24 months after surgery showed an evident improvement in nasal flow with significant reduction of resistance, confirmed by the statistical analysis. The average value for nasal resistance after treatment was $1.19 \pm 0.24\text{ Pa.cm}^3/\text{sec}$. At three months it was $0.65 \pm 0.14\text{ Pa.cm}^3/\text{sec}$ (p<0.001), at 12 months it was $0.48 \pm 0.12\text{ Pa.cm}^3/\text{sec}$ (p<0.001) and after 24 months it was $0.47\pm 0.14\text{ Pa.cm}^3/\text{sec}$ (p<0.001). No significant difference was found between the results obtained at three and twelve months after treatment (p = 0.25) (Figure 2).

DISCUSSION

APC has been successfully used for the hemostasis of superficial bleeding and for the resection of parenchymatous tissue in open abdominal surgery, laparoscopy and...
Thoracoscopy, for more than 20 years. It was introduced to the ENT field by the end of the 90s by professor Bergler’s team at the University of Mannheim. At first it was used for the treatment of recurrent epistaxis in Rendu-Osler-Weber disease. Subsequently it was used for the treatment of turbinate hyperplasia, tonsillectomies, palatoplasties and laryngo-tracheal endoscopic surgery.

In the past decade, various techniques have been used to reduce the volume of the inferior turbinates, ranging from submucous resection to partial or total turbinectomy. Various treatments for recurrent epistaxis have also been tried, amongst them cauterization, cryosurgery, monor bipolar electrocoagulation, Nd-YAG, CO₂ or KTP laser surgery. The use of APC in nasal surgery has allowed for good control of thermocoagulation, restricting it to the most superficial areas, given that the maximum penetration depth is only 3mm. Furthermore, the action of the argon plasma combines a reduction of surgical time with good tolerance and the absence of bleeding and thus the need for nasal packing. No septal perforation has been reported, even when it was necessary to work on both nasal fossae.

Even when there is an initial reactive oedema that may persist for up to seven days in more than half of the patients, at four weeks after surgery we can see a “tunnel shape” area in the lower part of the nasal fossae indicating a regeneration of the mucosa; a reestablishment of mucociliary clearance; moderate fibrosis of the submucosa; and a significant improvement in respiratory function.

Regarding the effects of APC in the physiology of the nasal mucosa, and especially in the mucociliary clearance, we found that six months after the intervention no patient complained of symptoms of nasal dryness and on the examination of the patient showed no evidence of atrophic rhinitis. The regeneration of the epithelial cells happens in the first three months, and mucociliary clearance is not significantly different in the treated areas.

Surgery with Nd-YAG laser shows similar advantages to those presented by APC, however, despite the fact that thermocoagulation is in direct relation to the distance between the source of emission and the tissue, there is a greater risk of septal perforation and damage to the submucosa. This means that oedema is almost always prolonged in the post-operative period. It is also known that laser surgery develops thermocoagulant effects even in areas which do not bleed, however APC, only produces effects in areas of high electrical conductivity. Furthermore, the specific use of Nd-YAG laser has been linked with fatal complications such as gaseous emboli.

CO₂ laser is also a useful alternative for the treatment of chronic turbinate hypertrophy, although it has the disadvantages of limited tissue penetration and difficult access to the posterior areas of the turbinate.

One additional advantage of APC is the complete absence of evaporation and carbonization, with a concomitant absence of toxic exhalations and a marked reduction in the production of scabs and fibrin during the regeneration of the mucosa. Furthermore, as opposed to other laser techniques, it is not necessary to take special safety measures during APC surgery.

CONCLUSION

APC is a new surgical technique based on the use of argon gas to coagulate and devitalize tissue that requires treatment.

The easiness of its use, the capacity for superficial thermocoagulation and the good tolerance from patients are its main characteristics.

APC can be used in nasal surgery (turbinates, recurrent epistaxis, Rendu-Osler-Weber disease), oropharyngeal surgery (palatoplasties, tonsillectomies) and endolaryngeal surgery (with flexible microscope and endoscopy) with very good results, reducing surgery time and time of stay in hospital.

Reduction of the inferior turbinate by means of APC is an alternative to medical treatment. In comparison with other methods it offers considerable advantages in the surgery for reduction of the inferior turbinates.
REFERENCES


