LETTER TO THE EDITOR

LONG-TERM RESULTS OF NASAL SURGERY: COMPARISON OF MINI-INVASIVE TURBINOPLASTY

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To the Editor,

Recent epidemiological data confirm the chronic increasing nasal obstructive disease in urban and industrialized areas, essentially due to the polluting and irritating agents that are breathed daily in the cities (1). The main cause of the pathology is represented by chronic hypertrophic rhinitis which is one of the most common diseases prevalent in the population (2, 3).

Pharmacological therapy is the first-line treatment and its failure represents the main indication for the surgical approach, to improve the nasal airflow but, above all, respecting the nasal mucosal integrity (4). The advent of minimally invasive surgery has allowed us to reduce subsequent drug treatment, positively influencing the quality of life of these patients (4). The two main objectives of surgical treatment are the increase in nasal airflow and the maintenance of the nasal mucosa, respecting, in particular, its physiological function. In the long term, however, both the stability of the size reduction and the absence of side effects that can reduce the patient's subjective well-being are essential (5). Often, research in this specific field of rhinology has been conditioned by the desire to apply new technologies, rather than motivated by an effective interest in correctly understanding the results obtained.

Based on these considerations, through our study, we analyzed the long-term outcomes of the two most common turbinoplasty techniques in the field of chronic hypertrophic rhinitis surgery: the radiofrequency technique with Coblation technology and the Molecular Quantum Resonance. We focused our attention on improving patient's symptomatology, respecting the nasal physiology and mucosal integrity.

MATERIALS AND METHODS

A randomized retrospective study was conducted at the ENT Clinic of the University of Catania (Italy) in collaboration with the Regional Center for Head and Neck Cancer of Treviso and the Vanvitelli University of Naples,

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to compare long-term results, efficacy and the safety of two of the most recent turbinate "plastic" surgical technologies. We conducted the study after acquiring the signed informed consent of each patient. The study was approved by the institutional review committee of the research committee of the Department of Medicine and Surgery, otorhinolaryngology section. The study was not advertised and no remuneration was offered.

A total of 254 patients (147 males and 107 females; aged 21-63 years), suffering from chronic nasal obstruction caused by non-allergic turbinate hypertrophy, were enrolled in this study. These patients did not respond to the usual medical treatment with topical steroids and local decongestants, and were monitored by medical therapy for at least 1 year. The subjects were randomly divided into two groups of 127 patients each, homogeneous for age and sex. One group was treated with radiofrequency coblation technology (CT group) while the other with Molecular Quantum Resonance (QMR group). Patients were evaluated based on clinical and medical history, objective clinical examination, nasal endoscopy, allergy tests, nasal cytology, rhinomanometric and radiological evaluation. The presence of significant septal deviations, previous surgery of the turbinate, nasal polyposis or recurrent sinusitis, coagulopathies, serious systemic or oncological diseases, and infections were exclusion criteria from the study. Other exclusion criteria were any pregnancy or lactation, insulin-dependent diabetes, and uncontrolled arterial hypertension.

We evaluated factors such as intra and post-operative pain and the use of analgesics, intra and post-operative bleeding, a variation of instrumental rhinomanometric parameters and cytofunctional changes of the nasal mucosa of treated patients. The surgical results of both procedures were evaluated at 1 week and 1 and 3 months after surgery. During the pre- intra- and post-operative period, the following elements were observed: nasal obstruction, intra and/or postoperative bleeding, surgical duration, post-operative pain, and crusting/synechiae formation. A VAS 0-10 scale was used to assess subjectively: nasal obstruction and postoperative pain in which a score was assigned from 0 (no symptoms) to 10 (the most severe symptom). The degree of mean surgical nasal bleeding was assessed intraoperatively and at the subsequent follow-ups using a 0-10 scale classification, divided into 4 classes (from none to severe). For the study of nasal resistance, an active rhinomanometry (Rhinomanometer Labat Srl, Venice, Italy) was performed during the preoperative period and also in the postoperative period at 1 and 3 months.

The nasal sample for cytological analysis was obtained by scraping the central part of the inferior turbinate using a rhino probe (Arlington Scientific Inc., Springfield, MA, USA). The samples were then placed on a slide, fixed with 2% glutaraldehyde, stained with 2% osmium tetroxide, dehydrated with alcohol and finally observed with a Hitachi 100 keV H-600 electron microscope (Tem image, Hitachi Ltd, Chiyoda, Japan). The cellular distribution, the different cytotypes, and the various intracellular components were discriminated against. Particular attention was paid to checking the integrity of hair cells, to detect the percentage of patients with cellular alterations. The cytological analysis was performed both in the preoperative period, and in the postoperative period 1 and 3 months after the operation.

Surgical procedure

All patients were treated by local contact anesthesia with 2% mepivacaine, for a duration of 15 min, placing cotonoids with recovery thread soaked in anesthetic along the whole turbinate. For the CT group, submucosal decongestion was performed by inserting a needle handpiece at the level of the head of the inferior turbinate and guiding it as far posteriorly as possible, without damaging the adjacent nasal septum, to reduce the incidence of postoperative nasal synechiae. Primarily, an ablation setting of six and coagulation setting of four were used, activated by a radiofrequency device (ArthroCare ENT Coblator II Surgery System, Austin Texas, USA) with a frequency of 1.7 KHz at a power of 5 W. The needle handpiece was positioned from tail to body and remained in each portion of the turbinate for 10 sec. This first surgical time was effective mainly on the middle and posterior portions of the inferior nasal turbinate.

Subsequently, to achieve adequate anterior turbinate reduction, a third submucosally lesion was performed using the same technique previously described. The submucosal decongestion of the turbinate was performed by means of insertion with a needle-shaped handpiece, activated by a QMR machine, so-called Quantum (Telea, Sandrigo-Vicenza, Italy), for a total of 20–30 sec, at an intensity force of 3.5. The wand was activated and moved

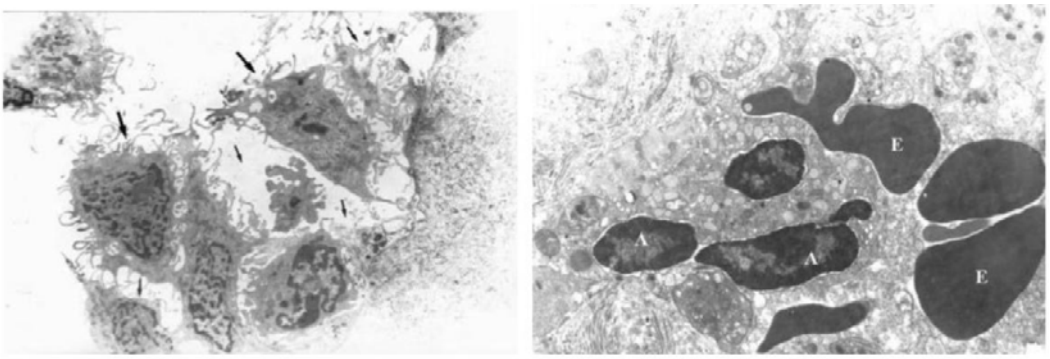
through the posterior, middle and anterior compartments, paying attention to avoid the superficial portion of the turbinate due their important physiological role. Postoperative bleeding did not require insertion of nasal tampons in any of the patients in the treatment group. Topical corticosteroid decongestant and nasal antiseptic cream were used in both groups twice a day for 1 week to help control epistaxis, and to decrease edema in the immediate postoperative period.

Statistical analysis

For all subjective and objective outcomes, the *p* value of improvement between groups was calculated and the *t*-test was used. Score significance was set at 0.05 to test the null hypothesis that there was no significant difference in reduction of objective and subjective nasal symptoms between control and treatment groups. Statistical analyses were performed using SPSS (software package used for statistical analysis) Statistics Version 17.0 (SPSS, Inc., Chicago, IL, USA).

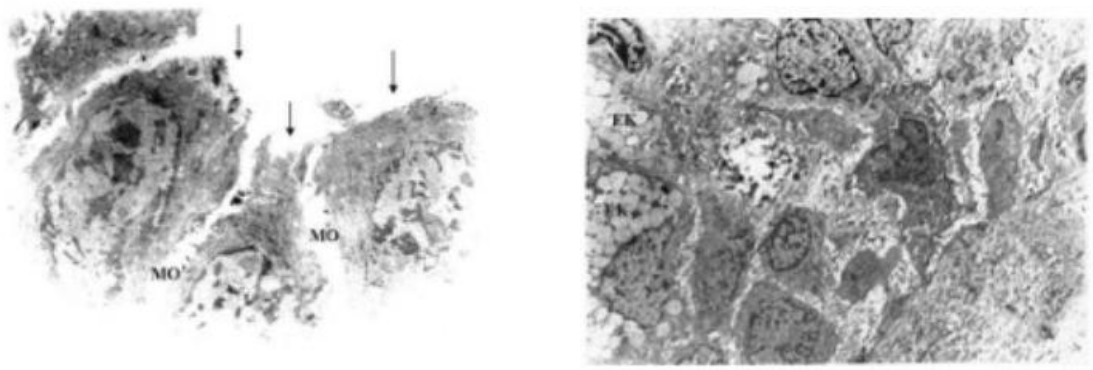
RESULTS

Already from the first postoperative week, active rhinomanometric examination showed an improvement in both study groups in terms of postoperative benefit obtained, in particular with regard to nasal obstruction (Table I). Considering the



a **b**

Fig. 1. ***a-b)*** *Electron microscopic images showing nasal epithelial metaplasia, evident stratification in the epithelium and hyperplasia, degeneration of epithelial cells, loss of cilia and destruction of intercellular connections.*



a **b**

Fig. 2. ***a)*** *Reduction of the intercellular edema, a slight reduction in mucus and an overproduction of collagen.* ***b)*** *No regeneration of the cilia in turbinate mucosa is present.*

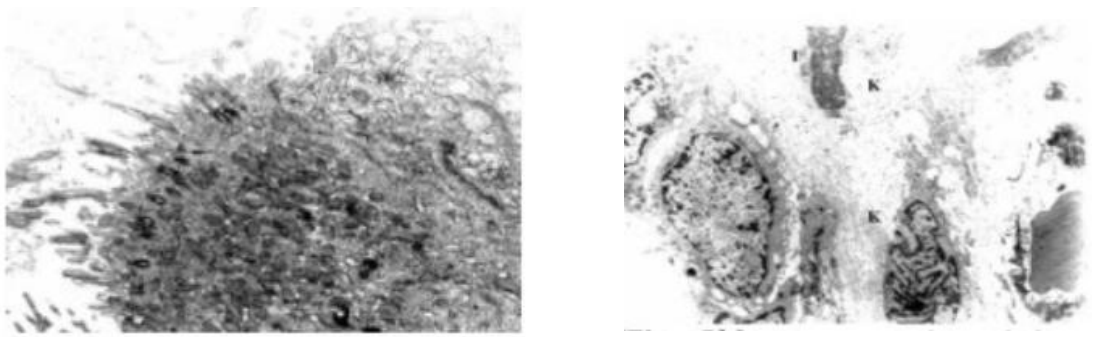
mean initial preoperative values, CT presented a better response to surgical treatment than QMR with a final average increase in nasal air resistance of about 72% *vs* 68%. However, no significant differences resulted when the postoperative outcomes at 1 and 3 months after surgery were compared between the two study groups (p = 0.1) (Tables I-II). The mean bleeding intraoperative score was 1.62 for CT patients *vs* 0.86 for the QMR, with a not significant value p = 0.5 (Table II). No bleeding occurred immediately after turbinate reduction treatment nor was nasal packing required. In the two control groups after the first postoperative week, fibrin layers were found near the nasal surgical site, which dissolved in the second postoperative week. The mean duration of surgery in the CT group was 11.7 min *vs* 11.3 min in the QMR group (Table II) (p> 0.05 not significant).

Surgical-related pain assessment was evaluated intraoperatively, at one week, one month and 3 months after surgery. Lower VAS scores were found in the QMR group from the intraoperative time of the surgical procedure (1.7), compared to the CT group (3.96). However, non-statistically significant differences in the two groups were noted (p = 0.14).

Regarding the problem of crusting/synechiae formation, 23 patients (18%) of the QMR group developed the disease along the lower edge and tail of the treated turbinate, however, this was completely resolved during the first week of follow-up. Conversely, the presence of scabs was not reported in the CT group.

On cytological examination in the preoperative period, the ciliated cells were pathological with ciliocitoftoria or cytoplasmic alterations in 28 cases (22%) of the QMR group and 32 (25%) of the CT group. Electron microscopic observation revealed nasal epithelial metaplasia, evident stratification in the epithelium and hyperplasia, degeneration of epithelial cells, loss of cilia and destruction of intercellular connections (Fig. 1a-b). In addition, increased thickness of the basement membrane, overproduction of nasal mucus, inflammation of the lamina propria and increase in the number of goblet cells were observed.

In the postoperative period, no significant alteration of the hair cells of the QMR patients was observed, ranging from 28 (22%) to 34 (27%) in the first month of follow-up and 28 (22%) at the third month of follow-up. Under the electron microscope, a reduction of the intercellular edema was observed, as well as a slight reduction in mucus (Fig. 2a) and an overproduction of collagen (Fig. 2b). However,



a **b**

Fig. 3. ***a****) Decreased mucus secretions and interstitial edema, widespread islands with normally organized epithelium of columnar cells and goblet cells combined with islands of metaplastic epithelium.* ***b****) Regenerated epithelium, containing cells with small, scattered cellular cilia and also hyperplasia reduction.*

the regeneration of the cilia in the mucosa of the turbinate was not observed. On the other hand, in the CT group there was a decrease in the number of patients with cellular modifications, passing from 33 (26%) to 29 (23%) at the first month of follow-up and finally to 20 (16%) in the third month.

Furthermore, decreased mucus secretions and interstitial edema were observed. Widespread islands with normally organized epithelium of columnar cells and goblet cells were evident (Fig. 3a), combined with islands of metaplastic epithelium. The islands of the regenerated epithelium contained cells with small, scattered cellular cilia on their surface starting from the third month (Fig. 3b). We also observed a reduction in hyperplasia. The functional activity of the mucosa in patients operated by CT remained unchanged at 1 and 3 months after surgery.

DISCUSSION

Numerous medical and surgical treatments have been proposed for the treatment of inferior turbinate hypertrophy (7-8). Our study was aimed at patients with chronic hypertrophic rhinitis of non-allergic etiology. The purpose of turbinate reduction surgery is to improve nasal obstruction, thanks to the formation of scar tissue that binds the mucosa to the periosteum and reduces a possible recurrence (9). The integrity of the mucous lining is essential to guarantee the preservation of normal nasal physiology, which can be monitored through the transport time of the ciliary mucus and nasal cytology (9).

Surgery involves the degeneration of the nasal epithelium, the presence of polynuclear cells with prominent nucleoli, areas of muciparic or platicellular epithelial metaplasia (10). We therefore

Table I. *RAA results (anterior active rhinomanometry)*

	PRE-OPERATIVE	POST-OPERATIVE 1 MONTH	POST-OPERATIVE 3 MONTHS
Group RQM	0.98±0.028 (Pa/cm^3/s)	0.37±0.021 (Pa/cm^3/s)	0.32±0.022 (Pa/cm^3/s)
Group CT	0.93±0.032 (Pa/cm^3/s)	0.33±0.027 (Pa/cm^3/s)	0.28±0.023 (Pa/cm^3/s)

Table II. *Comparison between intra- and post-operative results in both groups of patients.*

	Group RQM	Group CT	P value
Intraoperative nasal bleeding	0.86	1.62	> 0.05
Surgery duration (minutes)	11.3	11.7	> 0.05
Intra-operative pain assessment	1.7	3.96	> 0.05
Post-operative pain assessment			
1 week	0.7	0.9	> 0.05
1 month	0.35	0.54	> 0.05
3 months	0.1	0.2	> 0.05

analyzed and compared the effects and the possible advantages of two techniques of submucosal surgical decongestion for the hypertrophic turbinate, radiofrequency coblation technology and molecular quantum resonance technique, since the data in the literature show excellent results for both but, at times, demonstrate conflicting aspects (10, 11).

Evaluation of the degree of post-operative nasal obstruction showed improvement, particularly in the CT group. Evaluation of mean nasal bleeding showed reduced values in both study groups, but particularly in the QMR group. The evaluation of pain related to surgery showed lower VAS scores both intraoperatively and at follow-up in the QMR group compared to the CT group. The analysis of cytomorphological results showed the advantages of the CT technique compared to the QMR technique. In particular, a progressive increase in the number of normal cells in the CT group reflects a more rapid postoperative benefit. These advantageous results have been possible thanks to the multi-electrode end of the CT device which does not exceed the necrosis temperatures, with consequent reduction of damage to adjacent tissues.

However, in the literature there is still no treatment of choice for this type of pathology; the radiofrequency technique with CT, allowing greater precision with less tissue damage, as demonstrated in our study, seems to be characterized by greater fitness for a truly conservative treatment of the turbinal structures, especially in terms of restoration of nasal physiological function. Moreover, in our study, radiofrequency turbinoplasty presented excellent data in terms of postoperative outcomes, showing it to be the treatment of choice in the pathology of turbinate hypertrophy.

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