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Original article

Different Methods of Treatment of Inferior Turbinate Hypertrophy (A Meta-Analysis Study)

Kassem M .kassem, Aabdel-Hakem F. Ghallab, Mervat R. Mohamed

Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Egypt.

Corresponding to: Mervat R. Mohamed, Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Egypt.

Email:

mervat.rabie90@gmail.com

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Abstract

Background: The inferior turbinates are bony and soft tissue projections that protrude into the nasal passages. Turbinate hypertrophy is observed in allergic, vasomotor and infectious rhinitis which leads to chronic nasal obstruction. The **objective** of this study is to evaluate the published literature for treatment outcomes for inferior turbinate hypertrophy comparing partial surgical inferior turbinectomy, sub-mucosal diathermy and radiofrequency ablation. **Methods**: We searched PubMed, Scopus, Cochrane, and Web of Science, Embase, and Science Direct, till December 2021 with relevant keywords. We used the following search strategy :(Turbinate OR “Nasal Concha” OR “Nasal Conchae” OR “Conchae Nasales” OR “Conchae Nasale”) AND (Hypertrophy OR “Inferior turbinate hypertrophy") AND (Electrocautery OR Thermocoagulation OR Galvanocautery OR “Surgical Diathermy” OR “Diathermy, Surgical” OR “end cavitary Fulguration” OR “Fulguration, Endo cavitary”) AND (Randomized OR Randomized OR cohort OR prospective). **Results**: the metanalysis found that Radio frequency ablation significantly improved nasal discharge with p-value <0.00001, improved sneezing with p-value <0. 001. There was statistically significant effect of RFA on snoring with p-value<0.0001. There was no statistically significant effect of RFA on total nasal resistance with p-value=0.15 nor postnasal dripping with p-value =0.46. There was statistically significant effect of RFA on crust formation with p-value<0.0001. There was statistically significant effect of RFA on patient satisfaction VAS score with p-value<0.0001**.** **Conclusion**: A significant improvement of nasal obstruction, nasal discharge, sneezing, crust formation, snoring and patient satisfaction VAS score after radiofrequency ablation, was reported which makes it a reasonable choice in comparison to partial surgical inferior turbinectomy and sub-mucosal diathermy. But, there was insignificant effect of RFA on headache, total nasal resistance nor postnasal dripping.

Key words: Inferior Turbinate Hypertrophy - Treatment - Different Methods.

Introduction

Hypertrophy of the Inferior Turbinates (HIT) is one of the leading causes of chronic nasal obstruction which badly affect patients' quality of life. The Inferior Turbinate (IT) is an elongated, scroll-like, paired structure situated at the lateral nasal wall and made of a central core of osseous skeleton and a mucosal layer on each side of the bone [(1)].

However, hypertrophy of the inferior turbinate is a common cause of chronic nasal obstruction, still no agreement has been reached on how to deal with this problem. A number of interventions are available for the treatment of nasal obstruction secondary to inferior turbinate hypertrophy, including immunotherapy, antihistamines, intranasal corticosteroid sprays, decongestants, corticosteroid turbinate injections, cryosurgery, electro-cautery, out-fracture, total or partial turbinectomy, turbinoplasty, sub-mucous resection, radiofrequency energy tissue ablation and recently laser-assisted turbinoplasty. An ideal procedure for turbinate reduction should be associated with minimal discomfort or adverse reactions and should preserve the physiological function of the turbinate, such as regulating the humidification and temperature of the inspired air. All of the techniques have potential complications that fall into several categories. The main goal of turbinate surgery should be the preservation of mucosal surfaces with reduction of the submucosal tissue [(2)].

Surgical intervention improves the dynamic competence of the nasal airway by addressing the fixed obstruction and alleviates symptoms by reducing the effects of edematous mucosa [(3)].

Enlargement of the inferior turbinate is mainly due to swelling of the sub-mucosa and rarely due to enlargement of the bone itself. Hypertrophy of inferior turbinate caused by dilation of sub-mucosal venous sinusoids is the cause in intrinsic rhinitis, and responds to decongestant. Sometimes the inferior turbinate enlargement due to sub-mucosal fibrosis does not respond to decongestant [(4)].

Inferior turbinate hypertrophy due to venous sinusoid engorgement is a major contributing factor to obstruction at nasal valve level as well as inferior part of nose. Avoidance of allergen triggers, -though the definitive treatment,- is at times impractical. Pharmacotherapy provides symptomatic relief but does not cure the disease. Immunotherapy modifies the allergic response but does not always afford protection from an overwhelming antigen exposure. Therefore, other modalities of treatment which can reduce the symptoms mainly nasal obstruction, preserve the functional efficacy of nasal mucosa and avoid complications- are required [(5)].

The objective of this study was to evaluate the published literature for treatment outcomes for inferior turbinate hypertrophy following inferior turbinoplasty, through a meta-analysis. In this study, the techniques of partial surgical inferior turbinectomy, sub-mucosal diathermy and radiofrequency ablation- were selected for comparison.

Methods

After approval of the Medical Ethics Committee of Benha Faculty of Medicine (**The approval number of the local ethical committee**: 00056), we followed PRISMA statement guidelines [(6)] during this systematic review and meta-analysis preparation and performed all steps according to the Cochrane handbook of systematic reviews of intervention [(7)].

Search strategy and study selection

We searched PubMed, Scopus, Cochrane, and Web of Science, Embase, and Science Direct- till December 2021 with relevant keywords. We used the following search strategy for searching different databases:(Turbinate OR “Nasal Concha” OR “Nasal Conchae” OR “Conchae Nasales” OR “Conchae Nasale”) AND (Hypertrophy OR “Inferior turbinate hypertrophy") AND (Electrocautery OR Thermo coagulation OR Galvanocautery OR “Surgical Diathermy” OR “Diathermy, Surgical” OR “end cavitary Fulguration” OR “Fulguration, Endo cavitary”) AND (Randomised OR Randomized OR cohort OR prospective). All references of the included studies were screened for eligibility.

Eligibility criteria and study selection

Our inclusion criteria were as follow:

(1) Clinical studies which assess the clinical outcome after treatment of the inferior turbinate hypertrophy.

(2) Randomized clinical trials describing sub-mucosal diathermy, partial inferior turbinectomy, radiofrequency ablation for hypertrophied inferior turbinate.

(3) All of the studies must have been written in English as a full-text manuscript.

(4) Patients with unrelieved or partially relieved nasal obstruction after maximal medical treatment.

(5) Adult patients from 18 -55 undergoing inferior turbinate hypertrophy surgery treated by partial surgical turbinectomy, submucosal diathermy, or radiofrequency ablation (RFA) for management of inferior nasal hypertrophy.

(6) The included clinical comparative study can be either prospective or retrospective and should have contained up to 1-year follow-up or more.

(7) Double arm designs

(8) Either general or local anesthesia.

(9) Published from 2001 till 2021.

(10) Studies designs included randomized controlled trials (RCTs) or non RCTs including Cohort, Case controls, and case series either prospective or retrospective.

(11) All outcomes were accepted for inclusion.

(12) Any demographic characteristics were accepted for inclusion.

On the other hand, our exclusion criteria were as follow:

(1) Comparative studies of different comparisons which did not compare between any of the three techniques for inferior turbinate hypertrophy.

(2) Different study designs as Case report studies; Cross-sectional studies; Case series were excluded.

(3) Experimental studies.

(4) Studies not written in English

(5) Single arm design.

(6) Studies including less than five cases.

(7) Studies on patients with other nasal problems as severe septal deviation and nasal polyps, systemic diseases, respiratory tract infection, or radiation therapy.

(8) Studies on patients not completed 3 months follow-up.

All published articles were screened with no restrictions for data of search. Titles and abstracts were done in two parts, followed by full-text screening. Reference lists of the included studies were manually screened to find any other eligible studies that may be omitted from previous steps.

Quality assessment

Risk of bias was evaluated by the Cochrane handbook of systematic reviews of interventions 5.1.0 [(10)], which included the following risks: selection bias "through random sequence generation and allocation concealment," selective reporting, attrition bias, performance bias through blinding of participants, and personnel, detection bias through blinding of outcome assessment. Each bias domain is recorded as one of the following: low risk, high risk, or unclear risk.

Data Extraction

We obtained data from text, tables, figures (using graph grabber version 2.0), and supplementary data. We focused on the following outcome measures: Nasal obstruction VAS score, overall postoperative pain score (VAS), postoperative crustation, postoperative healing, postoperative nasal bleeding, postoperative nasal patency, postoperative nasal Discharge, sneezing, headache between pre and post radiofrequency ablation partial turbinectomy, snoring, postnasal dripping, mucociliary transport time measures (in minutes), total nasal resistance, and patients' satisfaction VAS score.

Statistical Analysis

We conducted this meta-analysis by Review manager software and using Open Meta Analyst (OMA) (Computer program) (Version 5.4. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). Regarding the study outcomes, risk ratio (RR) with 95% confidence interval (CI) was used for dichotomous variables, while the mean difference (MD) and 95% CI were presented for continuous variables. Cochrane's *P* values and I^2 were tested to examine heterogeneity among the studies. High heterogeneity most likely existed due to the clinical and methodological factors, so the random effect model was adopted in this meta-analysis even I^2 was small. Funnel plots and the Egger regression test could not be performed due to the limited number of the included trials in each forest plot.

Results

The analysis of the included studies showed a significant improvement in patients with inferior turbinate hypertrophy regarding pre and post radiofrequency ablation therapy after first- and third-months follow-up (MD = 1.93; 95% CI [0.56, 3.3]; P < 0.001) making RFA a reasonable choice for postoperative sneezing. The heterogeneity was high due to variable follow-up durations between the included studies (P < 0.0001; I^2 = 99%) **Figure 1.**

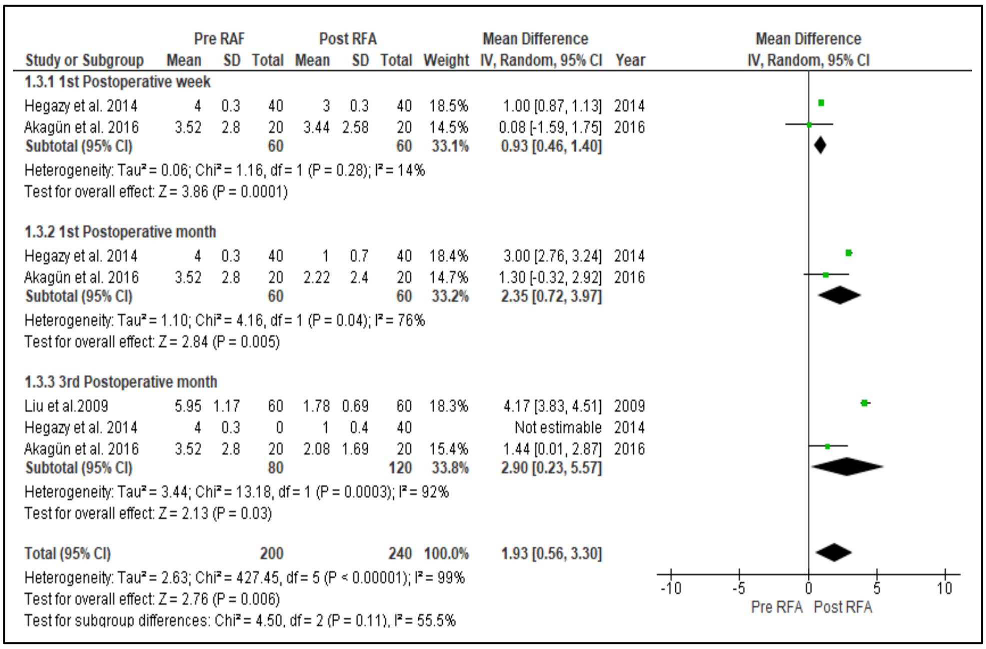

Fig. (1) : Forest plot of mean difference (MD) in sneezing between pre and post radiofrequency ablation partial turbinectomy.

The analysis of the included studies showed a significant improvement in patients with inferior turbinate hypertrophy regarding pre and post radiofrequency ablation therapy after third-month follow-up (MD = 4.64;95% CI [4.31, 4.94]; P < 0.0001) making RFA a reasonable choice for postoperative snoring. The heterogeneity was high due to variable follow-up durations between the included studies (P < 0.0001; I^2 = 93%) **Figure 2**.

The analysis of the included studies showed no significant difference between pre and postoperative postnasal dripping in patients with inferior turbinate hypertrophy regarding radiofrequency ablation therapy after one week, first- and third-months follow-up (MD = 0.35; 95% CI: [-0.59, 1.29]; P = 0.46). The pooled studies were homogenous (P = 0.64; I^2 = 0%) **Figure 3**.

The analysis of the included studies showed a significant improvement in patients with inferior turbinate hypertrophy regarding pre and post radiofrequency ablation therapy after one week, first- and third-months follow-up (MD = 5.33; 95% CI [3.88, 6.78]; P < 0.0001) making RFA a reasonable choice for postoperative patients' satisfaction VAS score. The heterogeneity was high due to variable follow-up durations between the included studies (P < 0.00001; I2 = 100%) **Figure 4.**

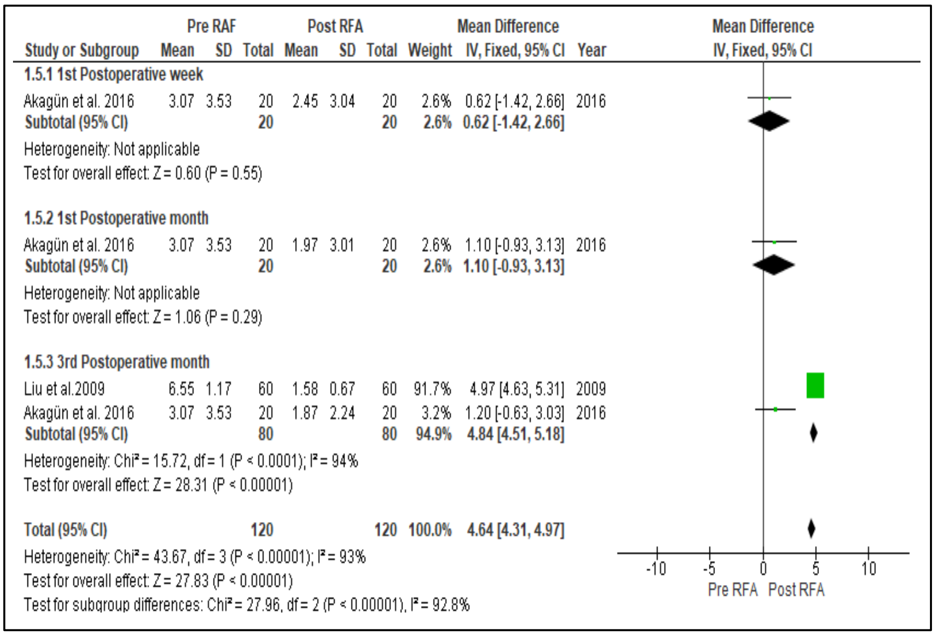

Fig. (2) Forest plot of mean difference (MD) in snoring between pre and post radiofrequency ablation partial turbinectomy.

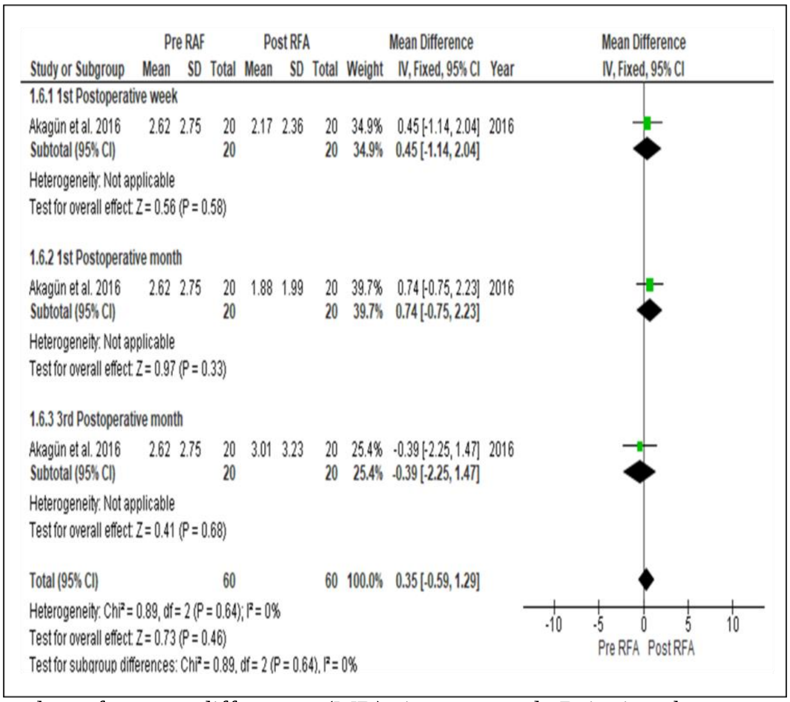

Fig. (3) Forest plot of mean difference (MD) in postnasal Dripping between pre and post radiofrequency ablation partial turbinectomy.

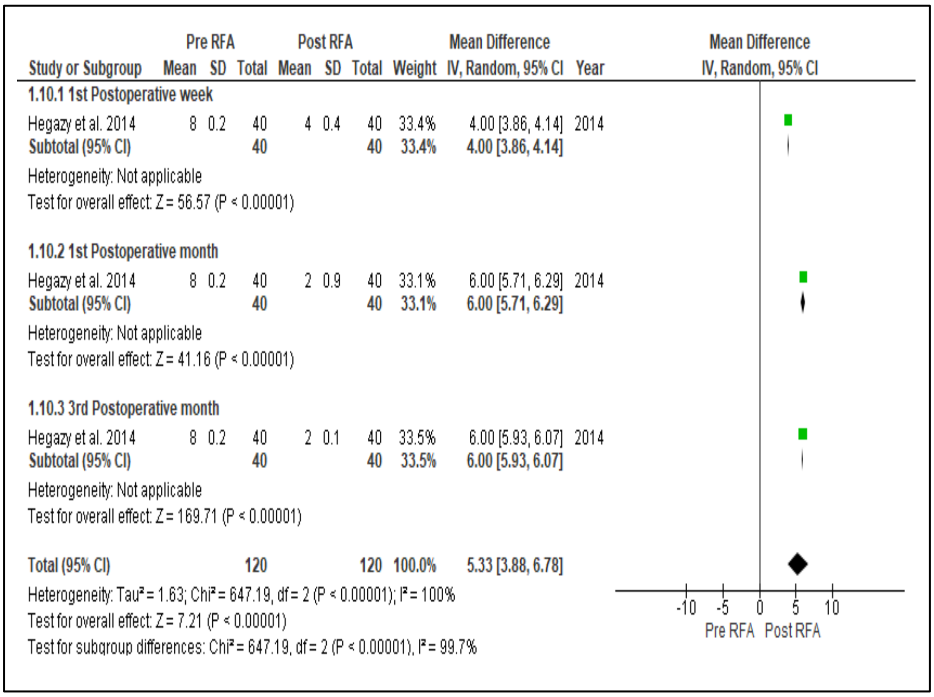

Fig. (4) Forest plot of mean difference (MD) in patients' satisfaction VAS score between pre and post radiofrequency ablation partial turbinectomy.

Discussion

In the current metanalysis, we used VAS score for nasal obstruction and there was no significant difference between partial surgical turbinectomy and submucosal diathermy for patients with inferior turbinate hypertrophy- regarding partial or complete improvement in nasal obstruction VAS score (p-value=0.74)- as there was no favorable technique between both techniques for mucosal reduction with p-value=0.56.

There were various studies, which showed that partial inferior turbinectomy is as effective procedure in relieving nasal obstruction as total inferior turbinectomy with success rate ranging from 70 to 80% [(5).] However, partial inferior turbinectomy should be performed cautiously in order to protect anatomical structures and physiological functions of nose. Monopolar diathermy is an old technique for the reduction of sub-mucosal tissue of the inferior turbinate, but still widely practiced [(8)]. Similarly [(9),] evaluated the efficacy of submucosal diathermy and partial inferior turbinectomy in the treatment of hypertrophied inferior turbinate. They found that both techniques were found to be effective in reducing nasal obstruction. Khosa et al. [(10)] studied the outcome of SMD and partial inferior turbinectomy in patients with chronic hypertrophic rhinitis in terms of relief of nasal obstruction. They found that both these procedures are simple and easy to perform; SMD leads to a dramatic fall in nasal obstruction but the patient do not have concurrent medical treatment, inferior turbinate re-hypertrophy within 15 months. They concluded that both the procedures are relatively safe and effective and do not need expensive instrumentation. In a study by Gomaa et al. [(8)] showed that both techniques- (submucosal diathermy and partial inferior turbinectomy) - were equally effective in improving of nasal obstruction and degree of tissue healing. The effect of submucous diathermy is achieved through coagulation of the venous sinusoids within the turbinate, leading to submucous fibrosis [(11).]

In contrast to the present results, Smitha et al. [(12)] analyzed and evaluated the efficacy of sub mucosal diathermy and partial inferior turbinectomy in the treatment of symptomatic hypertrophied inferior turbinates in allergic rhinitis patients. They found that in submucosal diathermy group, significant improvement of nasal airflow was seen in 14% of patients & 85.9% had moderate improvement. In partial inferior turbinectomy group, 41.3% of patients had significant improvement & 58.6% had moderate improvement. They concluded that partial inferior turbinectomy was found to be more effective in relieving nasal obstruction in allergic rhinitis patients for longer duration and with no major complications.

In addition, Nawaz et al. [(13)] found that all the patients in both groups- (submucosal diathermy (group, A) and partial inferior turbinectomy (group, B)) - had severe nasal obstruction pre-operatively. Three weeks post operatively in group A, 20 (25%) patients had no obstructive symptoms, 36 (45%) had mild obstructive symptoms while 24 (30%) had moderate nasal obstruction. While in group B, 58 (72.5%) felt complete relief with no-obstruction, 22 (27.5%) patients had mild obstruction while none had moderate or severe obstruction of nose. Post-operative nasal patency was significantly better in group B as compared to group A ($p < 0.001$).

In a study by Kalfe et al. [(14)] they compared effectiveness of sub mucosal diathermy and partial resection of inferior turbinate. Following six months of follow up, six patients of group undergoing SMD had recurrence with nasal blockage and in patients undergoing inferior turbinectomy none had recurrence. It was concluded that partial resection of inferior turbinates is better than SMD in long course.

A study studied the comparison between partial inferior turbinectomy and submucosal diathermy in the management of inferior turbinate hypertrophy. They found that partial inferior turbinectomy showed better and early results when compared to submucosal diathermy in terms of subjective improvement of symptoms. In addition, patients who underwent partial inferior turbinectomy showed marked improvement of nasal obstruction at the end of first week itself with 80% of them having total improvement while the remaining 20% said that the nasal obstruction was reduced to being a mild problem. At the end of second month, 49 patients [98%] had no nasal obstruction while only one patient said that it remained as a mild problem. They concluded that early and better results were seen in patients who underwent partial inferior turbinectomy [(5)].

A study evaluated and analyzed the impact of partial turbinectomy and SMD on nasal obstruction and to compare the results of either procedures in respect of safety and efficacy. They found that SMD is relatively safe and less invasive than partial turbinectomy but its effectiveness compared to partial turbinectomy is short lived and partial turbinectomy was found to be more effective [15].

In Akbar et al. there was significant improvement in nasal obstruction was seen in 92% of PIT and 80% of SMD at second post-operative week comparing submucosal diathermy and partial inferior turbinectomy in patients of inferior turbinate hypertrophy. [16].

The current meta-analysis found that RFA significantly improved nasal discharge related to inferior turbinate hypertrophy with p-value <0.00001. This goes in run with Türk et al. study which was conducted on 59 patients underwent radiofrequency ablation and revealed statistically significant improvement of nasal discharge (rhinorrhea) with p-value <0.001 [17].

There are reports regarding the effects of radiofrequency on symptoms other than nasal obstruction such as the management of rhinorrhea, sneezing, and itching of the nose and eyes [18]. Cukurova et al. [19] applied 450-480 J for each turbinate and indicated that RF procedure that was used by them was effective for reliving obstruction related to inferior turbinate hypertrophy (82% during five years). Matthew et al., reported that RFA is very effective for improvement of nasal obstructions in long-term follow-up of two years [20]. Because the submucosal layer is considered as the active zone where allergic reactions take place, it is supposed that rhinorrhea and congestion reduce due to the resultant decrease in the contact area for allergens, the destruction of submucosal glands, and the obliteration of small vessels due to scar formation [21].

The current meta-analysis found that RFA significantly improved sneezing related to inferior turbinate hypertrophy with p-value <0. 001. In some studies, the relief of sneezing after RFA was attributed to the destruction of the post-nasal nerve branches [22; 23; 24]. However, posterior nasal nerve responsiveness for the innervation of nasal mucosa is distributed on the whole nasal mucosa, so it is strange that just turbinate reduction can have so striking results. Furthermore, it has been suggested that dysregulation of sympathetic, parasympathetic, and regulating the nasal mucosal vascularity and glandular secretion. The application of radiofrequency energy to inferior turbinate submucosa induces submucosal small vessel obliteration and mucosal gland destruction, circumferential scar formation that are considered to play major role for these beneficial effects of RFA [25].

The current meta-analysis found that there was statistically significant effect of RFA on snoring with p-value<0.0001. This goes in run with Casale et al. study, which was conducted on thirty-two subjects with inferior turbinate hypertrophy underwent radiofrequency volumetric tissue reduction and revealed statistically significant improvement of snoring with p-value <0.001 [26; 27].

The current meta-analysis found that there was no statistically significant effect of RFA on total nasal resistance with p-value=0.15, nor postnasal dripping with p-value =0.46. Another study by Sahin- reported statistically significant improvement of nasal resistance measurements after RFA with p-value <0.001 [28].

The current meta-analysis found that there was statistically significant effect of RFA on crust formation with p-value<0.0001. Similarly, another study compared patients of inferior turbinate hypertrophy who treated with radiofrequency ablation versus bipolar electrocautery and revealed no significant reduction of postoperative crusting by the end of 1st week [29].

The current meta-analysis found that there was statistically significant effect of RFA on patient satisfaction VAS score with p-value<0.0001. Another study by De Corso et al. was performed on 305 patients affected by inferior turbinate hypertrophy and revealed slight worsening trend of global satisfaction of patients [30].

Conclusion

A significant improvement of nasal obstruction, nasal discharge, sneezing, crust formation, snoring and patient satisfaction VAS score in patients with inferior turbinate hypertrophy after radiofrequency ablation in comparison to partial surgical turbinectomy and sub-mucosal diathermy- was reported in our meta-analysis, which makes it a reasonable choice for postoperative nasal obstruction. But there was no effect of RFA on headache, total nasal resistance, postnasal dripping.

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