International Research Journal of Natural and Applied Sciences
Volume-1, Issue-7 (December 2014) ISSN: (2349-4077)

INTRATURBINATE DIATHERMY VS RADIOFREQUENCY FOR INFERIOR TURBINATE HYPERTROPHY

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ABSTRACT

Objective: To compare the efficacy and complications of Bipolar Submucosal Diathermy with Radiofrequency volumetric tissue reduction, in relieving chronic nasal obstruction unresponsive to medical treatment in inferior turbinate hypertrophy.

Study design: Prospective randomized clinical study

Method: The study was conducted on 50 patients with signs and symptoms of bilateral nasal obstruction due to inferior turbinate hypertrophy, refractory to medical therapy. The consented patients were randomized and divided in two groups (A and B) of 25 patients each. In group A, bipolar submucosal diathermy was performed while in group B, radiofrequency volumetric tissue reduction was applied to inferior turbinate. Nasal endoscopy, visual analogue scale, nasal patency measurement by Gertner's plate and saccharin tests were used to assess treatment outcomes at the end of 3 days, 1 week, 1 month and 3 months after surgery.

Results: The subjective improvement in nasal obstruction as graded by the patients with visual analogue scale scores was statistically significant bilaterally in both the groups at 1 month after treatment in all the patients. Objective improvement in nasal airflow as measured by Gertner's plate showed statistically significant improvement in both the groups bilaterally. The difference between the two groups as regards to visual analogue scale and the nasal airflow by Gertner's plate was not significant. The saccharin transit time confirmed maintenance of mucociliary mechanism in both the groups. The incidence of complications like synechiae, bleeding and crusting was found to be higher in diathermy group than radiofrequency group and was statistically significant. Early postoperative healing was observed in Radiofrequency volumetric tissue reduction.

Conclusion: Radiofrequency is a safe, effective and with fewer complications as compared to diathermy procedure. Thus it is advisable to perform radiofrequency volumetric tissue reduction as a first line treatment for patients with chronic nasal obstruction due to inferior turbinate hypertrophy, unresponsive to medical treatment.

Key words

Submucosal diathermy; radiofequency; inferior turbinate hypertrophy; nasal obstruction; mucociliary clearance**.**

Introduction

Nasal obstruction is widespread in the adult population and may affect the patient's health via prolonged respiratory infections, secondary sinus involvement, diminution of the sense of smell, and sleep disorders [1-4]. Chronic nasal obstruction is a frequent symptom that can result either from nasal and septal deformities or from mucosal disease associated with turbinate hypertrophy [5]. Inferior turbinate hypertrophy, caused by perennial allergic rhinitis and vasomotor rhinitis is usually bilateral and is caused by thickening of the mucosa without hypertrophy of the underlying bony structures [6]. Medical treatment including antihistamine, topical and systemic steroid, topical desensitization and allergen avoidance are used first, but if these measures fail, surgery is advised [2,7]. Many surgical procedures have been suggested to deal with hypertrophy of the inferior turbinates, including submucosal injection of sclerosants or corticosteroids, cryoturbinectomy, resection of the entire turbinate, submucosal resection of the

inferior turbinate, and laser turbinectomy [5,7-13]. The goal of turbinate surgery is to obtain an improvement of nasal breathing with preservation of the physiological function of the turbinate and minimal discomfort or adverse effects. The procedure of submucosal diathermy is based on the principle that coagulative current produces tissue necrosis, and the ensuing fibrosis causes shrinkage of the soft tissues of the turbinates. Radiofrequency volumetric tissue reduction is based on the principle of local submucosal delivery of radiofrequency energy which creates a focal lesion with no damage to the surrounding structures. The circumscribed area of submucosal necrosis is replaced over time by fibroblasts as part of normal repair process. Wound contraction leads to turbinate volumetric reduction and relief of nasal obstruction.

Material and method

The present study comprised of 50 patients with bilateral inferior turbinate hypertrophy complaining of chronic nasal obstruction unresponsive to medical treatment in the form of antihistamines, topical and systemic steroids and nasal decongestants. The patient age ranged from 16-58 years. All the patients were examined clinically and via endoscope. The written informed consent was taken from all the patients and clearance from hospital ethical committee was also taken before carrying out this study. Patients with previous surgery or marked deviated nasal septum and nasal polyps were excluded. Additional exclusion criteria included blood coagulation disorders, uncontrolled hypertension and diabetes mellitus, and other systemic diseases.

Each patient included in the study used a four point visual analogue scale (VAS) ranging from 0 to 3 (0- absent, 1-mild, 2-moderate, 3-severe) to grade nasal obstruction preoperatively.

The nasal patency was measured preoperatively by using Gertner's plate method. It is a chromium plated metallic plate 10 cm x 12 cm in size with a parting line dividing it in two halves of 10 cm x 6 cm each. Concentric semicircles with a gap of 1 cm apart are present over the plate. The plate was held horizontally beneath the nostril adjacent to columella and the patient was asked to breathe out through the nose gently. This causes fogging due to condensation of the vapors on the cold metal. The airflow for each side was calculated by the formula:

$= \pi \times \frac{\text{horizontal distance in cm}}{2} \times \frac{\text{vertical distance in cm}}{2}$

Mucociliary function assessment was done by the saccharin time measurement. It was measured without the use of topical anaesthetic agent to preclude its having any effect on ciliary movement. The saccharin time was measured by placing 15 mg of saccharin just behind the anterior end of inferior turbinate. Patient was instructed to swallow every 30 seconds until he or she tasted the sweetness in throat, at which time the test was stopped and the transit time was calculated.

The patients were divided into two groups (A and B) of 25 patients each by a process of continuous allotment and block randomization. Group A underwent bipolar submucosal diathermy and Group B radiofrequency volumetric tissue reduction.

Premedication was given as injection atropine 0.6 mg and injection diazepam 10mg intramuscularly 45 minutes prior to surgery. The procedure was performed with the patient lying supine with the head end inclined up at 15 degrees, under local anaesthesia with 4% xylocaine packs in both the nasal cavities and infiltration with 2% xylocaine with adrenaline 1:200000 (total amount 2-4 ml) into the anterior portion of each turbinate. Blood pressure, pulse rate and oxygen saturation were monitored during the procedure.

Bipolar submucosal diathermy (BSD)

In this technique, a bipolar electrode was inserted submucosally into the anterior end of the inferior turbinate superficial to the periosteum and current was applied by footswitch control till the anterior end was coagulated taking all the precautions to prevent charring of mucosa. Second site was in the middle and then in the posterior portion of the turbinate. Care was taken to avoid contact with ala, columella, or septum which could cause peripheral tissue injury. Direct contact with the conchal bone was avoided since this could result in bony necrosis and sequestrum formation.

Radiofrequency volumetric tissue reduction (RFVTR)

Radiofrequency energy was delivered at a frequency of 465 Hz by a radiofrequency generator using a handheld bipolar electrode. The active needle electrode was penetrated into the

anterior end of the turbinate up to a depth of 10 to 12 mm and radiofrequency energy was delivered for a period of 60-90 seconds.

Immediately after both types of procedures, a cotton applicator soaked with oxymetazoline was placed over the puncture site for a period of 2 minutes and each patient was observed for 5 minutes and then was discharged without restriction of normal activities. No nasal packing, topical ointment, steroids or nasal sprays were administered.

At each subsequent follow-up patient's again underwent VAS to grade nasal obstruction subjectively. Postoperative pain was also evaluated and patients were asked to report use of analgesics. The objective evaluation for relief of nasal obstruction was done using Gertner's plate after 3 days, 1 week, 1 month, and 3 months postoperatively. The saccharin test was repeated to observe and compare the compromise in mucociliary function if any. The nasal endoscopy was done as and when needed to specifically look for complications if any.

Results

All the data was collected, tabulated and analyzed. The statistical analysis was done by student's t-test. A p value of < 0.05 was considered statistically significant.

The two groups were comparable in age and gender distribution. Concerning the nasal obstruction as graded by the patients with VAS scores, in both the groups' symptoms began to improve after 1 week on both the sides. On comparing group A with group B, there was no statistically significant difference in relief of nasal obstruction after surgery as shown in Table I.

Nasal airflow as measured by Gertner's plate showed mean percentage improvement of 72.64±11.92 and 69.90±10.00 on right and left side respectively in group A, 3 months postoperatively. In group B, the mean percentage improvement at 3 months was 76.31±8.48 and 74.11±11.66 on each side respectively. There was no statistically significant difference in nasal flow improvement in two groups as shown in Table II.

In the saccharin test, normal mucociliary clearance time was maintained in both the groups postoperatively at each follow-up.

Bleeding was observed in 8 patients who underwent submucosal diathermy whereas in radiofrequency group it was reported in 1 patient only. Crusting was reported in 7 patients who underwent submucosal diathermy whereas in group B, it was reported in 1 patient only. There was a statistically significant difference in the incidence of complications between the two groups. Postoperatively synechiae was observed only in 1 patient of group A, which was managed by synechiae removal followed by gelfoam pack. Details are revealed in Table III.

Discussion

Successful surgical treatment of inferior turbinates requires reduction of tissue volume with preservation of mucociliary function. If too little tissue is removed, the obstruction persists. If excess tissue is burnt then mucociliary function is impaired and patients report crusting.

RFVTR is a surgical procedure that uses radiofrequency heating to induce submucosal tissue destruction [14]. The heat emanates from the tissue and not the electrode because the current generated induces ionic agitation at the cellular level with consequent heating of tissue. The target tissue temperature can be maintained in the range of 60˚C to 90˚C (protein denaturation leading to tissue coagulation occurs at 49.5˚C) and the heat dissipation is limited, thus limiting the damage to adjacent tissues. The healing process induces fibrosis with wound contraction, leading to tissue volume reduction. Temperature induced by electrocautery (750-900˚C) is significantly higher than that required for cell death and this result in significant heat propagation. Radiofrequency is considered to be more accurate, with minimal injury to collateral tissues. In our study, submucosal tissue reduction was done by two techniques, diathermy and radiofrequency, in which erectile tissues were removed while leaving the mucosa intact. Both techniques have proven to be equally effective. In both the groups, statistically significant improvements were observed from the first week, which continued till 3months, on each follow up, in both subjective and objective (Gertner's plate) evaluation of nasal obstruction. The reduction in the turbinate oedema and tissue shrinkage lead to improvement in nasal patency. In both the groups, nasal mucociliary function was preserved. Coste et al showed that even at 1 week after the procedure, ciliated cells were still present, with a normal cilary beat frequency and

were able to ensure effective mucociliary clearence as evaluated by the saccharin test [5]. Our clinical study supports this histological study.

The postoperative complications of bleeding, crusting and synechiae were reported to be higher in diathermy group. The incidence of bleeding was reported in 8 patients in Group A. Crusting was reported in 7 patients and synechiae was reported in 1 patient who underwent bipolar submucosal diathermy. The synechiae was excised and gelfoam kept. Also review of literature shows lower short and long term complications with Radiofrequency volumetric tissue reduction than submucosal diathermy. Fradis et al reported bleeding in 4% cases and crusting in 8% cases of submucosal diathermy [1]. Mamdour et al encountered 15% cases of nasal adhesions between the septum and puncture site with submucosal diathermy [15]. Porter et al did not report any case of bleeding, crusting and synechiae with Radiofrequency tissue reduction [16].

Conclusion

Bipolar submucosal diathermy and Radiofrequency volumetric tissue reduction are equally effective in improving both the subjective and objective nasal obstruction. But definitely, Radiofrequency volumetric tissue reduction has an edge over bipolar submucosal diathermy, keeping in view earlier postoperative healing and lesser incidence of complications like bleeding, crusting and synechiae. At present, we definitely prefer Radiofrequency volumetric tissue reduction as a first line treatment modality in patients with chronic nasal obstruction due to inferior turbinate hypertrophy unresponsive to medical treatment. .

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TABLE I: COMPARISON OF GROUP A WITH GROUP B IN RELIEVING NASAL OBSTRUCTION BY MEAN VISUAL ANALOGUE SCALE PRE-TREATMENT AND POST-TREATMENT

Nasal Obstruction At Time intervals	**Right Side**			**Left Side**		
	Group A (n = 25) Mean ± SD	**Group B (n = 25) Mean ± SD**	**P value**	**Group A (n = 25) Mean ± SD**	**Group B (n = 25) Mean ±SD**	**P value**
Pre-treatment	2.88±0.332	2.84±0.374	0.691	2.92±0.277	2.88±0.332	0.646
At 3 days (first follow-up)	2.80±0.408	2.76±0.436	0.739	2.88±0.332	2.80±0.408	0.451
At 1 week (2^{nd} follow –up)	1.20±1.258	1.52±1.388	0.397	1.12±1.269	1.84±1.313	0.054
At 1 month (3^{rd} follow-up)	0.60±0.913	0.44±0.712	0.493	0.56±0.917	0.40±0.816	0.518
At 3 months (5^{th} follow-up)	0.36±0.638	0.20±0.408	0.296	0.32±0.627	0.24±0.436	0.603

*$p > 0.05$: not significant; $p < 0.05$: significant

TABLE II: COMPARISON OF GROUP A WITH GROUP B IN MEAN PERCENTAGE IMPROVEMENT IN NASAL AIRFLOW BY GERTNER'S PLATE

Nasal Cavity Area At Time intervals	Right Side			Left Side		
	Group A (n = 25) Mean ± SD	Group B (n = 25) Mean ± SD	P value	Group A (n = 25) Mean ± SD	Group B (n = 25) Mean ±SD	P value
At 3 days (first follow-up)	32.21±10.63	35.71±12.86	0.300	31.19±10.16	36.17±14.70	0.170
At 1 week (2nd follow –up)	37.40±14.94	43.62±17.88	0.189	38.66±18.07	43.72±16.04	0.300
At 1 month (3rd follow-up)	67.60±12.13	69.91±10.01	0.468	67.42±10.115	71.63±12.64	0.200
At 3 months (5th follow-up)	72.64±11.92	76.31±8.48	0.216	69.90±10.00	74.11±11.66	0.177

*p > 0.05: not significant; p < 0.05: significant

TABLE III: SHOWING INCIDENCE OF COMPLICATIONS IN TWO GROUPS

Complications	Group A (n=25)	Group B (n=25)	P value
Bleeding	8 (32%)	1 (4%)	0.002
Crusting	7 (28%)	1 (4%)	0.054
Synechiae	1 (4%)	0 (0%)	-

*$p > 0.05$: not significant; $p < 0.05$: significant