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Original Research

Comparison of Outcome of Submucous Diathermy versus Radiofrequency Coblation in the Treatment of Inferior Turbinate Hypertrophy

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Abstract: **Objective:** To compare submucous diathermy and radiofrequency coblation for inferior turbinate hypertrophy in terms of postoperative pain, nasal obstruction, postoperative bleeding, and reduction in turbinate size. **Study Design,** Place and Duration: Randomized controlled trial conducted in the Department of Otolaryngology, Lahore General Hospital, Lahore, over 6 months (This study was conducted from May 2025 to October 2025). **Materials and Methods:** Fifty-eight adults aged 18-60 years with confirmed inferior turbinate hypertrophy and persistent nasal obstruction despite at least three months of medical treatment were included. Patients were allocated by lottery method to submucous diathermy (n=29) or radiofrequency coblation (n=29). Nasal obstruction was assessed using a Visual Analog Scale (VAS) before surgery and at 2 and 4 weeks. Postoperative pain was graded using the Guttman scale at 2 and 4 weeks. Bleeding was assessed by nasal endoscopy on postoperative days 7 and 14. Inferior turbinate size was measured by computed tomography before surgery and at 1 month. Data were analysed using SPSS version 26. **Results:** Baseline characteristics were similar between the two groups. Mean VAS scores were lower after radiofrequency coblation than after submucous diathermy at 2 weeks (2.80 ± 1.00 vs 3.50 ± 1.10; p=0.014) and 4 weeks (1.20 ± 0.60 vs 1.80 ± 0.90; p=0.004). Grade II-III pain at 2 weeks occurred in 27.6% of patients after coblation and 58.6% after submucous diathermy (p=0.017). Postoperative bleeding did not differ significantly between groups. Inferior turbinate size decreased significantly after both procedures, while the between-group difference at 1 month was not significant (p=0.134). **Conclusion:** Radiofrequency coblation was associated with lower early postoperative nasal obstruction scores and less early postoperative pain than submucous diathermy. Both procedures reduced inferior turbinate size, and postoperative bleeding and short-term anatomical reduction were comparable between the two techniques.

Keywords: Inferior turbinate hypertrophy; submucous diathermy; radiofrequency coblation; nasal obstruction; turbinate reduction.

INTRODUCTION

Inferior turbinate hypertrophy is a common contributor to chronic nasal obstruction and may occur alone or with other anatomical causes of impaired nasal airflow. In a large clinical assessment of patients with sinonasal complaints, inferior turbinate hypertrophy was identified frequently among patients with nasal airway obstruction.[1] Persistent obstruction may interfere with sleep, physical activity, concentration, and general quality of life. Initial management is directed at the underlying inflammatory or allergic component and commonly includes intranasal corticosteroids, antihistamines, decongestants, saline irrigation, and selected anticholinergic preparations.[2] Surgery is considered when symptoms remain troublesome despite adequate medical treatment. The purpose of turbinate surgery is to enlarge the nasal airway while preserving the mucosal surface and normal turbinate function as

far as possible.[3-5]

Several surgical techniques are available for inferior turbinate reduction, including partial turbinectomy, submucosal resection, turbinoplasty, laser procedures, cryosurgery, electrocautery, submucous diathermy, and radiofrequency-based methods.[3,4] Submucous diathermy uses electrical energy within the turbinate to produce controlled tissue coagulation, followed by fibrosis and reduction in tissue volume. The procedure is inexpensive and technically straightforward, but postoperative pain, crusting, mucosal injury, and bleeding may occur.[6,7] Radiofrequency coblation uses radiofrequency energy in a conductive medium to reduce submucosal tissue at a lower operating temperature than conventional cautery. The surface mucosa is largely preserved, which may reduce early postoperative discomfort and crust formation.[7] These differences are relevant when a procedure is selected for patients who require turbinate reduction after failure of medical treatment.

Direct comparative evidence between submucous diathermy and coblation remains limited. Salem et al. reported improvement in nasal obstruction after both procedures, with lower postoperative obstruction scores and less pain on the side treated with coblation; turbinate size was reduced after both techniques.[8] Ercan et al. demonstrated improvement in subjective nasal obstruction and objective turbinate volume after radiofrequency treatment, while Uluyol et al. also reported significant symptomatic improvement after radiofrequency thermal ablation and bipolar electrocautery.[9,10] Systematic reviews indicate that several mucosal-sparing procedures improve nasal obstruction, but no single technique has shown consistent superiority across all clinical and objective outcomes.[3,4] Local randomized evidence comparing these two commonly used procedures is limited. The present study therefore compared submucous diathermy with radiofrequency coblation in adults with inferior turbinate hypertrophy, focusing on postoperative pain, nasal obstruction, postoperative bleeding, and reduction in turbinate size.

MATERIALS AND METHODS

A randomized controlled trial was conducted in the Department of Otolaryngology, Lahore General Hospital, Lahore. This study was conducted from May 2025 to October 2025. Ethical approval was obtained from the relevant institutional review authority, and written informed consent was obtained from all participants before enrolment. The sample size was 58 patients, with 29 participants in each group. It was calculated using expected postoperative VAS scores for nasal obstruction of 1.20 ± 0.41 after radiofrequency coblation and 1.77 ± 1.01 after submucous diathermy, with a 95% confidence level and 80% power, based on the previously reported comparative study.[8] Patients meeting the selection criteria were enrolled using simple random sampling and were allocated to the two treatment groups by the lottery method.

Adults aged 18-60 years with confirmed inferior turbinate hypertrophy, nasal obstruction for more than six months, and inadequate response to intranasal corticosteroids and antihistamines for at least three months were included. Patients were excluded if they had another major cause of nasal obstruction, including nasal polyps, septal deviation, sinusitis, or other significant sinonasal disease; uncontrolled allergic rhinitis or ongoing immunotherapy; previous nasal or turbinate surgery; systemic disease affecting the nasal mucosa; pregnancy or breastfeeding; a bleeding disorder or anticoagulant use; inability to follow the study protocol; or cognitive impairment affecting consent and compliance. Baseline assessment included medical history, ENT examination, preoperative VAS score for nasal obstruction, and computed tomography in coronal, sagittal, and axial planes using 2-mm cuts. Inferior turbinate size was measured in millimetres at its widest diameter.

All procedures were performed under general anesthesia with orotracheal intubation. Cotton pledgets soaked in noradrenaline 1:200,000 were placed in both nasal cavities for approximately five minutes before surgery. Group A underwent submucous diathermy. After endoscopic assessment, a diathermy needle was inserted into the submucosal tissue and controlled energy was applied to the anterior, middle, and posterior parts of the hypertrophied turbinate while limiting injury to the surface mucosa. Group B underwent radiofrequency coblation using the Arthrocare Coblation II system with a Reflex 45 wand. The system was set at level 4 in coblation mode and level 2 in coagulation mode. The wand was advanced to the required depth according to turbinate size, and coblation was applied for 10 seconds at each marked depth through two to three passages involving the superior, middle, and inferior areas. Postoperative treatment included antibiotics, analgesics, systemic decongestants, avoidance of nose manipulation and forceful nose blowing, removal of nasal packs after 48 hours when used, and saline irrigation for one month.

Postoperative pain was assessed using the Guttman scale at 2 and 4 weeks. Nasal obstruction was recorded on a 0-10 VAS at the same visits. Postoperative bleeding was assessed by endoscopic nasal examination on days 7 and 14 and recorded as present or absent. Inferior turbinate size was reassessed by computed tomography at 1 month by a consultant radiologist. Data were recorded on a structured proforma and analysed using SPSS version 26. Normality of continuous variables was assessed with the Shapiro-Wilk test. Continuous variables were presented as mean ± standard deviation and

categorical variables as frequency and percentage. Independent-samples Student t tests were used for between-group continuous comparisons, paired t tests for within-group preoperative and postoperative comparisons, and Pearson chi-square or Fisher exact tests for categorical outcomes according to expected cell counts. Mean differences and odds ratios were reported with 95% confidence intervals where appropriate. Analyses were also stratified by age, gender, and duration of nasal obstruction. A p-value below 0.05 was considered statistically significant.

RESULTS

A total of 58 patients were included and allocated equally to submucous diathermy and radiofrequency coblation, with 29 patients in each group. All patients completed the planned 1-month follow-up. The overall mean age was 33.75 ± 10.00 years, 37 (63.8%) patients were male, and the mean duration of nasal obstruction was 19.15 ± 7.60 months. Preoperative VAS score and computed tomographic turbinate size were similar in the two groups. Baseline demographic and clinical characteristics are presented in Table 1.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants

Characteristic	Submucous diathermy (n=29)	Radiofrequency coblation (n=29)	Total (n=58)
Age, years	33.10 ± 10.30	34.40 ± 9.80	33.75 ± 10.00
Male gender	19 (65.5%)	18 (62.1%)	37 (63.8%)
Female gender	10 (34.5%)	11 (37.9%)	21 (36.2%)
Duration of nasal obstruction, months	18.80 ± 7.20	19.50 ± 8.00	19.15 ± 7.60
Preoperative VAS score	8.10 ± 1.00	8.00 ± 1.10	8.05 ± 1.05
Preoperative turbinate size, mm	9.20 ± 1.10	9.10 ± 1.20	9.15 ± 1.15

Note. Continuous variables are presented as mean ± standard deviation and categorical variables as frequency (percentage). Baseline characteristics are presented descriptively because treatment allocation was randomized. VAS = Visual Analog Scale.

Nasal obstruction scores decreased in both groups after surgery. At 2 weeks, the mean VAS score was 3.50 ± 1.10 after submucous diathermy and 2.80 ± 1.00 after radiofrequency coblation, with a mean difference of 0.70 points (95% CI 0.15-1.25; t=2.54, p=0.014). At 4 weeks, the corresponding scores were 1.80 ± 0.90 and 1.20 ± 0.60, respectively (mean difference 0.60, 95% CI 0.20-1.00; t=2.99, p=0.004). The reduction from baseline to 4 weeks was significant within both treatment groups (paired p<0.001). Mean turbinate size at 1 month was 6.40 ± 0.80 mm after submucous diathermy and 6.10 ± 0.70 mm after radiofrequency coblation. The between-group difference was not statistically significant (MD 0.30 mm, 95% CI -0.10 to 0.70; p=0.134), while the reduction from baseline was significant within both groups (paired p<0.001).

Table 2: Continuous Nasal Obstruction and Turbinate Size Outcomes

Outcome	Submucous diathermy (n=29)	Radiofrequency coblation (n=29)	Mean difference (95% CI)	p
Preoperative VAS	8.10 ± 1.00	8.00 ± 1.10	0.10 (−0.45 to 0.65)	0.719
VAS at 2 weeks	3.50 ± 1.10	2.80 ± 1.00	0.70 (0.15 to 1.25)	0.014
VAS at 4 weeks	1.80 ± 0.90	1.20 ± 0.60	0.60 (0.20 to 1.00)	0.004
Preoperative turbinate size, mm	9.20 ± 1.10	9.10 ± 1.20	0.10 (−0.51 to 0.71)	0.742
Turbinate size at 1 month, mm	6.40 ± 0.80	6.10 ± 0.70	0.30 (−0.10 to 0.70)	0.134

Note. Data are presented as mean ± standard deviation. Between-group comparisons were performed using the independent-samples Student t test. Within each treatment group, the reduction in VAS score from baseline to 4 weeks and the reduction in turbinate size from baseline to 1 month were significant (paired t test, p<0.001 for each comparison). CI = confidence interval; VAS = Visual Analog Scale.

At 2 weeks, Grade II-III pain was recorded in 17 (58.6%) patients after submucous diathermy and 8 (27.6%) after radiofrequency coblation (χ^2=5.69; OR 3.72, 95% CI 1.24-11.17; p=0.017). At 4 weeks, Grade II pain remained in 7 (24.1%) and 2 (6.9%) patients, respectively, and no Grade III or IV pain was recorded; the difference was not statistically significant (Fisher exact p=0.144). Postoperative bleeding was identified in 6 (20.7%) patients after submucous diathermy and 2 (6.9%) after coblation on day 7 (Fisher exact p=0.253), and in 2 (6.9%) versus 0 patients on day 14 (p=0.491). The direction of the 4-week VAS difference remained in favour of radiofrequency coblation after stratification by age, gender, and duration of nasal obstruction. The between-group difference reached statistical significance among patients aged 18-40 years, males, and patients with symptoms for more than 12 months, while

the remaining strata showed the same direction without statistical significance.

Table 3: Postoperative Pain and Bleeding According to Treatment Group

Outcome	Submucous diathermy (n=29)	Radiofrequency coblation (n=29)	Effect estimate (95% CI)	p
Pain at 2 weeks: Grade I	12 (41.4%)	21 (72.4%)	—	—
Pain at 2 weeks: Grade II	11 (37.9%)	7 (24.1%)	—	—
Pain at 2 weeks: Grade III	6 (20.7%)	1 (3.4%)	—	—
Pain at 2 weeks: Grade IV	0	0	—	—
Grade II–III pain at 2 weeks	17 (58.6%)	8 (27.6%)	OR 3.72 (1.24–11.17)	0.017
Pain at 4 weeks: Grade I	22 (75.9%)	27 (93.1%)	—	—
Pain at 4 weeks: Grade II	7 (24.1%)	2 (6.9%)	OR 4.30 (0.81–22.80)	0.144
Bleeding at day 7	6 (20.7%)	2 (6.9%)	OR 3.52 (0.65–19.17)	0.253
Bleeding at day 14	2 (6.9%)	0	—	0.491

Note. Values are presented as frequency (percentage). The 2-week pain comparison was based on Grade II-III versus Grade I because no Grade IV pain occurred. Pearson chi-square was used when expected cell counts were adequate, and two-sided Fisher exact test was used for sparse cells. OR = odds ratio; CI = confidence interval.

DISCUSSION

Both submucous diathermy and radiofrequency coblation improved nasal obstruction and reduced inferior turbinate size during the first postoperative month. Radiofrequency coblation produced lower nasal obstruction VAS scores at 2 and 4 weeks and a lower frequency of Grade II-III pain at 2 weeks. The pain difference was no longer significant at 4 weeks. Postoperative bleeding was infrequent in both groups, and the reduction in turbinate size at 1 month did not differ significantly between procedures. The findings therefore indicate a difference in early postoperative symptoms, while the short-term anatomical response was similar.

The improvement in nasal obstruction agrees with the direct comparison by Salem et al., in which both submucous diathermy and coblation reduced nasal obstruction, with better postoperative symptom scores after coblation.[8] Radiofrequency procedures have also produced meaningful improvement in nasal obstruction in studies by Ercan et al. and Uluyol et al.[9,10] Shah et al. found similar improvement in nasal obstruction after coblation and intramural bipolar cautery, although coblation caused less early postoperative discomfort.[11] Hegazy et al. reported significant symptom improvement after both coblation and microdebrider-assisted turbinate reduction, with less postoperative pain after coblation.[12] Comparable symptomatic benefit has also been reported in longer follow-up studies of coblation and other radiofrequency techniques.[13,14] These findings support the observed reduction in VAS scores after both procedures in the present study.

The difference in early postoperative pain is also consistent with previous clinical studies. Coblation is designed to reduce submucosal tissue while limiting thermal injury to the surface mucosa. In the study by Shah et al., coblation was less painful than bipolar cautery during treatment and in the early postoperative period.[11] Hegazy et al. similarly reported less postoperative pain after coblation than after microdebrider-assisted reduction.[12] Singh et al. found that coblation and microdebrider-assisted turbinoplasty were both effective, with low postoperative morbidity.[15] A randomized trial comparing coblation with high-intensity focused ultrasound also showed improvement in nasal obstruction after coblation, although early crusting remained an important postoperative observation.[16] The lower frequency of Grade II-III pain at 2 weeks in the present study is therefore compatible with the reported early recovery profile of coblation. The difference had reduced by 4 weeks, indicating that it was mainly an early postoperative finding.

Postoperative bleeding did not differ significantly between the two treatment groups. The numerical frequency was higher after submucous diathermy, but the confidence intervals were wide because the number of bleeding events was small. Previous comparative studies have also reported low or similar bleeding rates after mucosal-sparing turbinate procedures.[8,11,12,15] Recent comparative studies of commonly used turbinate procedures have reported improvement after submucous diathermy, coblation, radiofrequency, microdebrider-assisted turbinoplasty, and electrocautery, with differences mainly in postoperative morbidity and complication profiles.[17,18] In the present study, computed tomographic measurements showed significant reduction in turbinate size after both procedures, without a significant difference between groups at 1 month. Earlier work has similarly shown that radiofrequency treatment and conventional surgical procedures can both produce measurable turbinate volume reduction despite differences in symptom recovery and postoperative morbidity.[9,19]

Preservation of turbinate mucosa remains an important consideration because the inferior turbinate contributes to regulation of nasal airflow,

humidification, filtration, and mucociliary function.[3,5] Radiofrequency-based procedures have generally been developed to reduce submucosal volume without removing large amounts of mucosa. Harju et al. found preservation of mucociliary function after radiofrequency ablation and microdebrider-assisted turbinoplasty.[20] Long-term studies have also reported sustained improvement in nasal obstruction after radiofrequency treatment, although the degree of benefit may change with time.[13,21,22] Earlier randomized evidence showed that different turbinate procedures can provide long-term benefit but may differ in mucociliary recovery and postoperative complications.[23] Systematic reviews have reached a similar conclusion: several procedures improve nasal obstruction, while the balance between symptom relief, objective airflow, bleeding, mucosal preservation, and long-term durability differs between techniques.[4,24,25]

The 4-week VAS difference remained in the same direction after stratification by age, gender, and duration of nasal obstruction, although statistical significance was not reached in every stratum. The lack of significance in some strata was likely related to the small number of patients after stratification and the resulting loss of precision. These subgroup findings should be regarded as evidence of a consistent direction of effect rather than as evidence of treatment interaction. A larger sample would be needed to determine whether the treatment effect differs according to demographic or clinical characteristics.

This study had several strengths. Treatment allocation was randomized, group sizes were equal, anesthesia and postoperative care were standardized, and outcome assessment was performed at predefined time points. Both patient-reported nasal obstruction and radiological turbinate size were assessed. The study also had limitations. It was conducted at a single tertiary hospital and included 58 patients. Follow-up was limited to 1 month, so recurrence, later crusting, mucosal healing, and persistence of symptom improvement could not be assessed. VAS and Guttman pain grading are subjective measures, and blinding of patients and operating surgeons was not feasible.

CONCLUSION

Submucous diathermy and radiofrequency coblation both improved nasal obstruction and reduced inferior turbinate size in patients with inferior turbinate hypertrophy. Radiofrequency coblation was associated with lower nasal obstruction scores and less pain during the early postoperative period, while postoperative bleeding and short-term turbinate size reduction were comparable between the two procedures. These findings support the use of either technique for turbinate reduction, with the choice influenced by early postoperative comfort, equipment availability, and local surgical practice. Longer follow-up is required to determine whether the early symptomatic difference persists over time.

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