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Original Article

Evaluating Outcome of Radiofrequency Surgery for Obstructive Sleep Apnea

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Abstract

Introduction: A substantial portion of patients with obstructive sleep apnea (OSA) seeks alternatives to positive airway pressure (PAP), the usual first-line treatment for the disorder and one option is upper airway surgery. Radiofrequency surgery presents a promising alternative for the treatment of snoring and in OSA. Radiofrequency for upper airway reconstructive surgery in sleep-disordered breathing for the nasal inferior turbinate, the soft palate, and the tongue base offers additional therapeutic options in the surgical armamentarium in an area in which there were once limited options.

Aim: This study aims to study the effectiveness of radiofrequency as an isolated method of surgery and to characterize the changes in the pattern of surgical sleep care.

Materials and Methods: Patients with complaints of snoring, frequent awakening at night, excessive daytime sleepiness, hallucinations, and choking in sleep are further evaluated. Patients are given a choice of using continuous PAP (CPAP) as a treatment for OSA. Hence, patients who defer CPAP and those failed with CPAP are prepared for radiofrequency surgery.

Results: Twenty-one (77.8%) underwent radiofrequency reduction surgeries, however, the other 6 (22.2%) with uvulopalatopharyngoplasty. Electrophysiologic study shows that there is overall 95.2% reduction or normalization of scoring in post-operative period after radiofrequency reduction and 4.8% with Grade 2 improvement. Polysomnography shows that (81.8%) there is complete reduction in apneic spells and 33.3% of reversal from severe to normalization. However, there is 19.0% reversal of severe-to-mild disease.

Conclusion: The important advantage of this procedure is technically simple and minimally invasive; they are associated with reduced post-operative pain compared with traditional surgical approaches, and they can be performed in an outpatient setting under local anesthesia with a low complication rate and generally good therapeutic results.

Key words: Radiofrequency ablation, Obstructive sleep apnea surgery, hypopneic snore

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a component of sleep-disordered breathing and this disorder is characterized by excessive snoring and periodic apneas, hypopneas, and arousals that lead to fragmented sleep in a repetitive specific duration. OSAS is a disease of modern ages and identified as distinct entity for the past 20–25 years.[1,2] At present, OSAS has been identified as a separate risk factor or an entity for increased susceptibility to stroke, myocardial infarction, cardiac arrhythmias, hypertension, dyslipidemia, insulin resistance and diabetes mellitus, depression, and sexual dysfunction. Impairment of alertness also increases the risk of susceptible patients to occupational hazards and automobile accidents.[3] Sleep is a transient state of altered consciousness and perceptual disengagement from one's surrounding environment. Moreover, the sleep phenomenon is an active process associated with profound physiological alterations involving complex interactions and processing among various parts of brain, especially cortical and diencephalic structures. Under normal circumstances, body physiological systemic functions associated with sleep occur without any serious consequences. However, in pathological states, the changes ensue in any of these systemic functions may present serious physiological risks with consequences that affect the qualitative and quantitative aspects of sleep and daytime functions.[4-6] Henceforth, majority of this renewed interest

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within the otolaryngologists has been focused on sleep-related breathing disorder OSA, and this recognition has led to a multidisciplinary approach with a creation of new medical discipline – sleep medicine, with a team made up of otolaryngologists, pulmonologists, neurologists, maxillofacial surgeons, and behavioral psychologists.

Aim

This study aims to study the effectiveness of radiofrequency as an isolated method of surgery and to characterize the changes in the pattern of surgical sleep care.

MATERIALS AND METHODS

This prospective study was conducted in the department of otorhinolaryngology at tertiary care hospital. All patients who attend our operative with the complaints of snoring, frequent awakening at night, excessive daytime sleepiness, hallucinations, and choking in sleep are further evaluated.

Inclusion Criteria

The following criteria were included in the study:

- Age between 25 and 50 years.
- Both sexes (male and female).
- Body mass index (BMI) >30 and <40.
- Neck circumference >17 inches for men and >16 inches for women.
- Polysomnography confirming OSA/sleep-disordered breathing.
- Unsuccessful or refused continuous PAP (CPAP) therapy.

Exclusion Criteria

The following criteria were excluded from the study:

- Age <25 years and >50 years.
- Hypothyroidism and other metabolic disorders.
- BMI >40.
    - Circumferential and hypopharyngeal collapse in Decision Integration and Support Environment (DISE).
- Associated craniofacial abnormalities.

All the patients undergo clinical examination followed by blood investigations, especially thyroid function test and BMI evaluation. Then, special investigations such as polysomnography, dynamic magnetic resonance imaging (MRI), and cephalometry are taken. The patients who fulfill the inclusion criteria are further followed up and prepared for DISE investigation. These patients are given a choice of using CPAP as a treatment for OSA. Hence, patients who defer CPAP and those failed with CPAP are prepared for radiofrequency surgery.

Surgical Technique

Pre-operative preparation is mainly designed to reduce the risk of infection. Oral antibiotics active against oral and pharyngeal flora are given approximately 30 min before surgery and continued postoperatively for 3 days, along with oral antimicrobial rinse. Anesthesia is achieved with a combination of a topical anesthesia applied to the oral surface of the soft palate and tongue. Local anesthetic with a vasoconstrictive agent, approximately 2–4 ml, is then infiltrated into the muscle tissues, especially at the sites of probe insertion. Pain referred to occiput is the most predominant complication in those with inadequate local anesthesia. An important advantage of submucosal radiofrequency is delivering of energy to the muscle without injuring the mucosa. Radiofrequency energy is typically delivered to the soft palate musculature midway between the posterior nasal spine and the free edge of the soft palate in midline, paramedian, or lateral locations. The midline and paramedian locations are thick formed by the soft palate musculature due to the presence of musculus uvulae; therefore, larger amount of energy is delivered to these sites including levator and tensor veli palatini muscles. Usually, one to three lesions are created during each session and these can be combined as two paramedian lesions or a midline and two lateral lesions. All patients are carefully watched for any signs of complications, especially bleeding, and they are discharged following day of surgery. Patients are followed up at 3 weeks and 6 weeks, during these visits, they are clinically examined and questioned regarding recurrence of previous symptoms and complications after surgery. After completion of 8 weeks, all patients are evaluated with post-operative polysomnography, dynamic MRI, and electrophysiologic study (EPS) questionnaire.

RESULTS

A total of 27 patients were included in the study comprising 18 males and nine females. This eventually shows that 66.7% are male and 33.3% are female; hence, it relies on that OSA is most common in males. In this group of patients, 21 (77.8%) underwent radiofrequency reduction surgeries; however, the other 6 (22.2%) with uvulopalatopharyngoplasty (UPPP). EPS, there is significant population falls in the mild scoring of 10–12 (44%). Polysomnography shows a significant population of 41% among 26–50 of apnea–hypopnea index (AHI). There is a significant accumulation of patients in the study population among nil association with other nasal and pharyngeal muscle hypertrophy. Radiofrequency reduction was done in combination of various structures. 21 (78%) underwent radiofrequency reduction surgery and 6 (22%) with UPPP [Figure 1]. There is a significant population with complete reduction

of snoring (74%) after surgery. There is 74% complete abolition of sleep awakening. EPS, there is a shift of scoring toward the lower side with a frequency of 23 in the study population signifying 85%. There is a significant accumulation of population in the nil side with frequency of 20 accounting 74%. The most common complication encountered was pain accounting 26% of total study population [Figure 2]. Comparison of pre- and post-operative snoring results, in which among the total study population of 100%, there is a significant reduction of snoring to only loudness with 18.5% and to wake others with 7%, and there is a complete absence of snoring in 74% [Figure 3]. Comparison of pre- and post-operative sleep awakening in which among the total study population with awakening (100%), there is a significant population in post-operative absence of sleep awakening (65%). 100% reduction of pre-operative EPS scoring from 10 to 12 and 0 to 10, while there is 50% reduction from 12 to 24 among the post-operative scoring. There is 78% complete removal of obstructive site in dynamic MRI in the post-operative period of the total study population. There is a mean reduction in symptom score of 0.593 when compared between the pre- and post-operative scoring [Figure 4]. Comparison of pre- and post-operative snoring results in radiofrequency reduction surgery in which among the total study population of 100%, there is complete absence of snoring in 81% in post-operative period; but, while using UPPP, there only 50% shift among the total study population. Comparison of pre- and post-operative sleep awakening results in radiofrequency reduction surgery, in which among the total study population of 100%, there is complete absence of sleep awakening in 81% in post-operative period; but, while using UPPP, there only 50% shift among the total study population. Comparing the EPS scoring parameter between the pre-operative and the post-operative group for radiofrequency reduction is statistically significant, $P = 0.043$. Comparison of pre- and post-operative polysomnogram-AHI results in radiofrequency reduction surgery, in which among the total study population of 100%, there is reduction of scoring to <1–81% in post-operative period; but while using UPPP, there only 50% shift among the total study population [Figure 5 and 6].

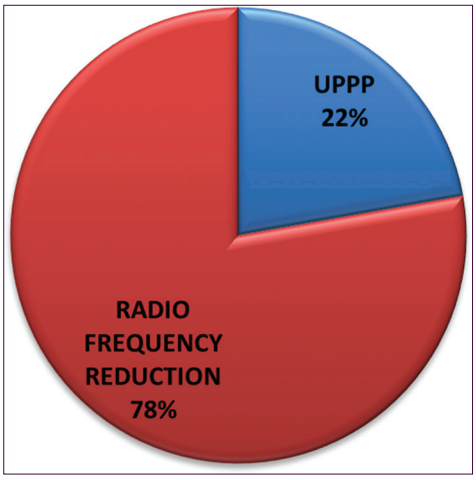

Figure 1: Distribution of surgery

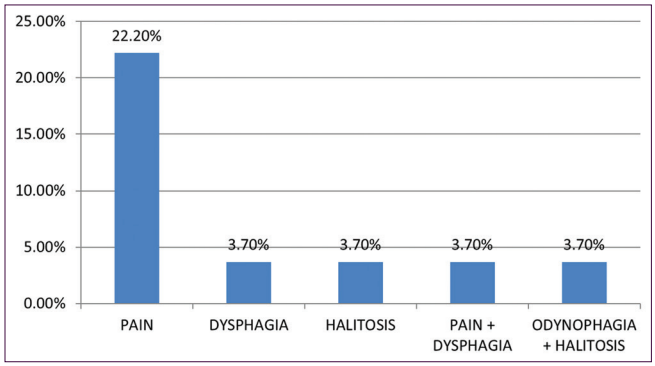

Figure 2: Distribution of complications

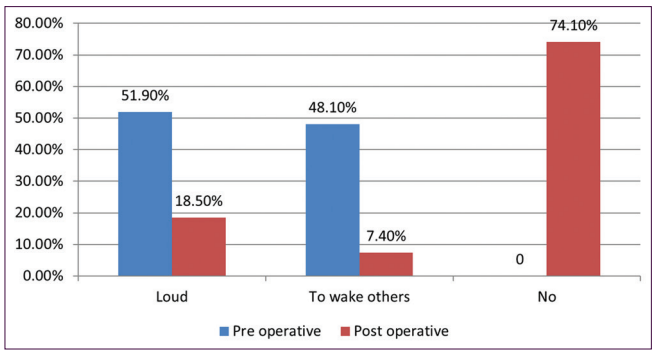

Figure 3: Distribution of snoring

DISCUSSION

The study was started with the aim of comparing the outcome of radiofrequency surgery in OSA and snoring patients. The study population chosen was scrutinized with proper implementation of the inclusion criteria. The confounding factors like other systemic disorders are excluded from the study. Various symptoms and signs are compared pre- and post-operatively.

Woodson *et al.*[7] conclude that comparison of radiofrequency ablation, CPAP, and placebo, there was no significant results are not obtained when compared with placebo. However, there was moderate decrease in AHI and rheumatic fever (RF) patients reported statistically significant improvements in "quality of life, airway volume, apnea index, and respiratory arousal index." The major limitation of the study is due to loss of significant population in the follow-up period. Fibbi *et al.*[8] reported that at 6 months, 67% of lingual suspension and 75% of radiofrequency patients had success. At 24 months, the success rate

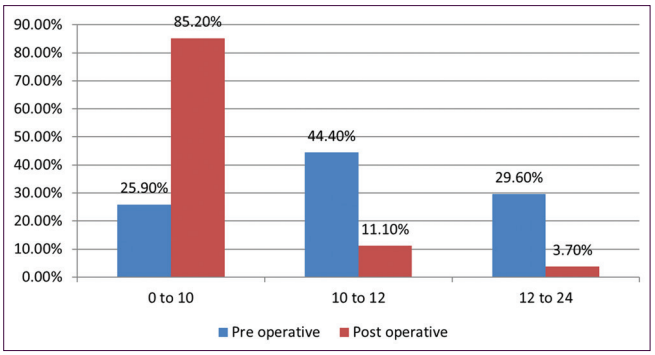

Figure 4: Distribution of electrophysiologic study

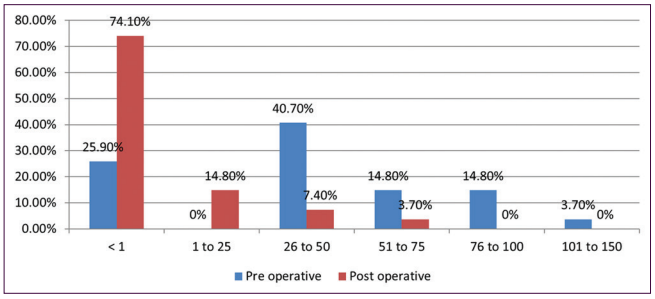

Figure 5: Distribution of polysomnogram

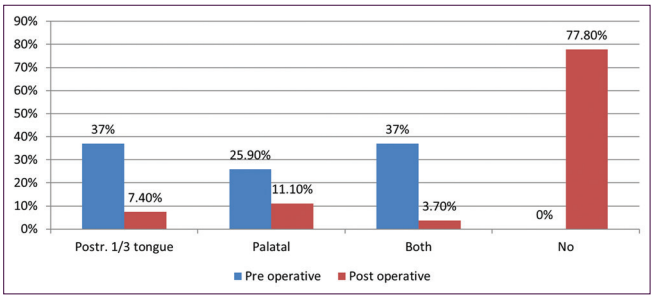

Figure 6: Distribution of dynamic magnetic resonance imaging

dropped to 42% and 33%, respectively. Wilhelmsson *et al.*[9] proved that mandibular advancement devices are better than UPPP. The parameters used for assessment in this study are apnea index, AHI, and blood oxygen saturation. There was a statistically significant result in patients using mandibular advancement device compared to UPPP. Walker-Engström *et al.*[10] reported that the response rate, defined as a >50% reduction in the post-operative respiratory disturbance index, was 51% of UPPP-treated patients and 47% of LAUPP-treated patients. Patients in the UPPP group had higher respiratory disturbance indexes before surgery (52.1) compared with those who underwent LAUPP (30.3), which may have had an impact on outcome.

CONCLUSION

Radiofrequency surgery should be considered as the treatment of choice for mild OSA and hypopneic snorers. Nevertheless, the necessity of repeated treatment sessions and the significant costs for the radiofrequency generators and needle devices should be kept in mind as a disadvantage of this technique. Future studies will aid in delineating the specific role of RF in sleep-disordered breathing.

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