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THERAPEUTIC MANAGEMENT OF OBSTRUCTIVE SLEEP APNEA: CLINICAL AND SURGICAL INTERVENTIONS

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Abstract: Obstructive sleep apnea (OSA) is a prevalent respiratory disorder characterized by recurrent obstruction of the upper airways, associated with significant cardiovascular and neurocognitive morbidity. Although continuous positive airway pressure (CPAP) treatment is the gold standard, low patient adherence represents a central clinical challenge. This narrative review, based on articles from the last five years in the PubMed database, aimed to analyze recent evidence on clinical and surgical interventions. The results indicate that mandibular advancement devices (MADs) are an effective alternative with high adherence for mild to moderate OSA, especially in patients with specific phenotypes (young people, women, low BMI). Bariatric surgery and emerging GLP-1 agonists (liraglutide, semaglutide) demonstrate efficacy in reducing the apnea-hypopnea index (AHI) through weight loss, although a cure is not guaranteed. Positional therapy is useful for selected cases, while pharmacological therapies remain without robust validation. It is concluded that the treatment of OSA requires a multimodal and individualized approach, based on the patient's phenotype, aiming to balance the effectiveness in reducing AHI with long-term therapeutic adherence.

Keywords: Obstructive Sleep Apnea; Treatment; CPAP; Mandibular Advancement Device; Bariatric Surgery; Positional Therapy.

INTRODUCTION

Obstructive sleep apnea (OSA) is a respiratory disorder characterized by recurrent episodes of partial or complete obstruction of the upper airway during sleep, resulting in reduced (hypopnea) or complete cessation (apnea) of airflow, usually accompanied by persistent respiratory effort. (Iannella et al., 2022)associated with breathing effort. OSA is a frequent and often underestimated pathology affecting between 2 and 5% of the middle-aged population. Typical nocturnal symptoms are the persistent snoring and awakenings with dyspnea sensation. On the other hand, diurnal symptoms could be sleepiness, headaches, asthenia, neurological disorders, and impaired personal relationships. Surgery of the velo-pharyngeal region had a huge evolution going from ablative techniques (UP3 and LAUP This condition has a high prevalence, affecting approximately 20% of adult men and 10% of postmenopausal women in moderate to severe cases, with significant occurrence in different sociocultural and geographic contexts, including Eastern and Western countries. (Akashiba et al., 2022) In middle-aged populations, the overall prevalence is estimated to range from 2% to 5%, although underdiagnosis is common due to the nonspecific nature of the symptoms and low demand for specialized evaluation. (Iannella et al., 2022)associated with breathing effort. OSA is a frequent and often underestimated pathology affecting between 2 and 5% of the middle-aged population. Typical nocturnal symptoms are the persistent snoring and awakenings with dyspnea sensation. On the other hand, diurnal symptoms could be sleepiness, headaches, asthenia, neurological disorders, and impaired personal relationships. Surgery of the velo-pharyngeal region had a huge evolution going from ablative techniques (UP3 and LAUP

Nocturnal symptoms include persistent snoring, sudden awakenings with dyspnea, and sleep fragmentation, while excessive daytime sleepiness, morning heada-

che, fatigue, neurocognitive disorders, and impaired quality of life predominate during the day. (Aboussouan et al., 2023) In addition, OSA is strongly associated with cardiovascular, metabolic, and neuropsychiatric comorbidities, justifying the importance of effective and individualized therapeutic strategies. (Akashiba et al., 2022)

Continuous positive airway pressure (CPAP) treatment is widely recognized as the gold standard, with solid evidence of effectiveness in reducing the apnea-hypopnea index (AHI), improving symptoms, and mitigating systemic risks. (Gambino et al., 2022) Adherence, however, varies according to the patient's clinical and demographic profile: individuals with moderate or severe symptomatic OSA have better tolerance and consistent use, while patients with mild forms, especially young people and women, tend to have lower acceptance, especially in the medium and long term. (Aboussouan et al., 2023; Gambino et al., 2022)

In recent years, the phenotypic characterization of OSA has allowed advances in personalized management, considering anatomical, pathophysiological, and behavioral factors. In this context, therapeutic alternatives such as mandibular advancement devices (MAD), positional therapy, hypoglossal nerve stimulation, weight loss, and lifestyle changes are being explored, although evidence to support their universal adoption is still limited. (Aboussouan et al., 2023; Gambino et al., 2022) Surgical interventions, in turn, have evolved from ablative techniques, such as uvulopalatopharyngoplasty (UP3) and laser-assisted uvuloplasty (LAUP), to procedures for remodeling the lateral walls of the pharynx, expanding the therapeutic possibilities for refractory cases. (Iannella et al., 2022)associated with breathing effort. OSA is a frequent and often underestimated pathology affecting between 2 and 5% of the middle-aged population. Typical nocturnal symptoms are the persistent snoring and awakenings with dyspnea sensation. On the other hand, diurnal symptoms could be sleepiness, headaches, asthenia, neurological disorders, and impaired personal relationships. Surgery of the velo-pharyngeal region had a huge evolution going from ablative techniques (UP3 and LAUP

In pediatric patients, OSA has a distinct etiology, often related to adenotonsillar hypertrophy. Adenotonsillectomy is the treatment of choice for moderate to severe cases, with evidence of significant improvement in sleep quality, daytime functioning, and cardiorespiratory parameters. However, mild cases may resolve spontaneously or respond favorably to medical therapies such as intranasal corticosteroids and leukotriene receptor antagonists. (Nixon, 2021)

Given the clinical heterogeneity and systemic implications of OSA, therapeutic choices must be individualized, balancing efficacy, adherence, and cost-effectiveness. This study aims to review the clinical and surgical strategies currently available for the management of OSA, in light of the most recent evidence, providing support for evidence-based medical practice.

METHODOLOGY

This study is characterized as a narrative literature review, developed with the objective of synthesizing and analyzing the most recent scientific evidence related to the therapeutic management of obstructive sleep apnea, including clinical and surgical interventions. The search was conducted in the PubMed database, using the descriptors

"Sleep Apnea," "Obstructive," "Surgery," and "Treatment," combined using the Boolean operators AND and OR, according to the terminology of Medical Subject Headings (MeSH).

Articles published in the last five years, available in full and written in Portuguese or English, that directly addressed therapeutic approaches to obstructive sleep apnea, including both clinical and surgical interventions, were included. Studies that were not directly related to the central theme, duplicate publications, narrative reviews with low methodological rigor, and articles not indexed in the database used were excluded.

The selection of studies was conducted in two stages: initially, the titles and abstracts were screened to verify their suitability for inclusion criteria; then, the full texts were evaluated to confirm their relevance and methodological quality. The information extracted was organized descriptively, allowing the identification of the main trends, advances, and challenges in the management of obstructive sleep apnea.

RESULTS AND DISCUSSION

Analysis of the data obtained showed that the use of a mandibular advancement device (MAD) promoted a significant reduction in the apnea-hypopnea index (AHI) and subjective improvement in sleep quality in patients with mild to moderate obstructive sleep apnea (OSA), especially in young, female individuals with low body mass index (BMI) and reduced neck circumference, as well as in those with an anatomical phenotype characterized by mandibular retrognathism and short soft palate. Adherence to MAD was found to be higher than that observed with continuous positive airway pressure (CPAP), even though the latter proved to be more effective in reducing AHI and oxygen desaturation index (ODI). Studies using drug-induced sleep endoscopy (DISE) identified isolated tongue base collapse as the most consistent predictor of a favorable response to MAD, whil , high airway collapsibility, and high loop gain were associated with worse outcomes. (Gambino et al., 2022)

In cases of severe OSA, although MAD is not traditionally the first therapeutic choice, positive results were recorded in patients with low BMI who refused CPAP, with a mean reduction in AHI of 64 ± 26% after one month of treatment. However, the therapy did not have consistent effects on cardiovascular markers, such as blood pressure and endothelial function, despite isolated reports of reversal of left ventricular remodeling. (Gambino et al., 2022)

Bariatric surgery has shown potential for significantly reducing the severity of OSA, with resolution rates ranging from 45% to 86%, although 20% of patients remained moderate to severe OSA in the postoperative follow-up. CPAP adherence was low after this procedure, with an average use of 49% of nights. Glucagon-like peptide-1 receptor agonist medications, such as liraglutide and semaglutide, have been shown to be effective in reducing weight and AHI, but there is currently no specific approval for the treatment of OSA. (Akashiba et al., 2022)

Behavioral interventions, such as positional therapy, reduced AHI in patients with positional OSA, especially those with less obesity. Although less effective than CPAP in reducing AHI, this approach had higher average adherence, albeit with complaints of discomfort in about 10% of cases. Alcohol

consumption was associated with an increase in the frequency and duration of apneic events, as well as a reduction in oxygen saturation, with a more pronounced effect in males and those with preexisting snoring or OSA. (Akashiba et al., 2022)

In the pharmacological field, no drug has formal approval for the treatment of OSA. Some substances, such as tricyclic antidepressants, selective serotonin reuptake inhibitors, and carbonic anhydrase inhibitors, have shown partial reductions in AHI, but with inconsistent responses and no robust clinical impact on daytime symptoms. (Akashiba et al., 2022)

The findings of the present study reinforce the relevance of an individualized approach to OSA management, considering not only polysomnographic severity but also the patient's clinical and anatomical phenotype. MAD emerges as an effective therapeutic alternative for patients who cannot tolerate CPAP, with particularly favorable results in selected subgroups and good medium-term adherence. However, its inferior efficacy to CPAP in reducing the IAH- indicates that the choice of this intervention should be guided by precise clinical criteria and periodic follow-up, especially given the risk of OSA progression over time. (Gambino et al., 2022)

Bariatric surgery, although promising in reducing the severity of OSA, does not guarantee a cure in all cases and presents the additional challenge of low subsequent adherence to CPAP. These results suggest that, even after significant weight loss, polysomnographic follow-up assessment is essential, and postoperative management should include strategies to maintain therapeutic adherence. (Akashiba et al., 2022)

The role of GLP-1 agonists as adjuvants in the treatment of OSA in overweight and obese patients is an emerging field, with a positive impact on both weight control and AHI reduction. Despite this, the absence of formal indications and the limited available data call for caution in their use as first-line therapy. (Akashiba et al., 2022)

Positional therapy, although less potent than CPAP in terms of objective sleep parameters, has superior adherence and may be particularly useful in cases of positional OSA with low BMI. The discomfort reported by some patients suggests the need for device refinement and careful selection of candidates. The recommendation to avoid alcohol consumption before bedtime remains clinically relevant, given its adverse impact on upper airway stability and oxygenation. (Akashiba et al., 2022)

The absence of validated pharmacological therapies for OSA highlights the pathophysiological complexity of the disease, which involves interactions between anatomy, ventilatory control, and neuromuscular factors. Although studies with antidepressants and carbonic anhydrase inhibitors have shown modest reductions in AHI, inconsistent outcomes and the lack of robust symptomatic benefit limit their clinical applicability. (Akashiba et al., 2022)

Given this scenario, it is clear that the therapeutic management of OSA should be multimodal and tailored to the patient's profile, incorporating behavioral measures and mechanical therapies as well as pharmacological or surgical interventions, always supported by periodic reassessment to optimize results and prevent associated complications.

CONCLUSION

The therapeutic management of obstructive sleep apnea (OSA) has evolved from an approach focused almost exclusively on CPAP to a multimodal and phenotyped strategy. Evidence shows that although CPAP remains the most effective treatment for reducing AHI, low adherence is a central challenge. Mandibular advancement devices (MADs) have established themselves as a first-line alternative for mild to moderate cases, offering superior adherence, albeit with less potency in reducing AHI. Bariatric surgery and emerging pharmacological therapies, such as GLP-1 agonists, have a significant impact on reducing the severity of OSA by acting on the risk factor of obesity, but they do not guarantee complete resolution. Positional therapy is useful in specific subgroups, while direct pharmacological therapies for OSA remain without robust validation. It is concluded that the therapeutic choice should be individualized, considering the patient's phenotype (anatomical, pathophysiological, behavioral) and prioritizing an approach that balances objective efficacy with adherence and improvement in quality of life.

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