USE OF NITROUS OXIDE IN ELDERLY PATIENTS WITH COMORBIDITIES: AN INTEGRATIVE REVIEW

USO DO ÓXIDO NITROSO EM IDOSOS COM COMORBIDADES: REVISÃO INTEGRATIVA

USO DE ÓXIDO NITROSO EN PERSONAS MAYORES CON COMORBILIDADES: UNA REVISIÓN INTEGRADORA

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Ana Beatriz Nunes Santos e Silva Barroso[1], Joyce Costa Moreira[2]

ABSTRACT

Nitrous oxide (N_2O) is widely used for conscious sedation in outpatient settings, particularly in dentistry, due to its favorable pharmacological profile, characterized by rapid onset of action, easy titration, and predictable recovery. Its use has been consolidated as an effective strategy for anxiety control, improvement of patient cooperation, and facilitation of clinical procedures with greater comfort and safety. In this context, its application in elderly patients with comorbidities represents a relevant alternative, especially in scenarios that require less invasive approaches and greater physiological stability. This study aimed to evaluate the safety and clinical applicability of N_2O for conscious sedation in this population through an integrative literature review. The literature search was conducted in PubMed/MEDLINE, SciELO, and ScienceDirect databases using descriptors related to "nitrous oxide," "conscious sedation," "elderly," and "comorbidities," and a total of 12 scientific articles were included. The findings indicate that N_2O presents a consistent safety profile, particularly when used in controlled concentrations and under appropriate monitoring, with clinical risks more strongly associated with patients' baseline conditions rather than the agent itself. Metabolic effects, especially those related to vitamin B12, should be considered in a contextualized manner, particularly in individuals with pre-existing conditions, and do not constitute an absolute limitation to its use. In addition, advantages such as maintenance of spontaneous ventilation, rapid recovery, and broad clinical applicability are highlighted. In conclusion, N_2O represents a viable, safe, and effective strategy for conscious sedation in elderly patients with comorbidities, provided it is used judiciously, with individualized assessment and structured clinical protocols.

Keywords: Nitrous Oxide. Conscious Sedation. Elderly. Comorbidities. Clinical Safety.

RESUMO

O óxido nitroso (N_2O) é amplamente utilizado na sedação consciente em contextos ambulatoriais, especialmente na odontologia, devido ao seu perfil farmacológico favorável, caracterizado por rápido início de ação, fácil titulação e recuperação previsível. Sua

[1] Specialist in Implant Dentistry. Specialist in Orofacial Harmonization (HOF). Specialist in Endodontics. Faculdade Herrero. Facsete. Centro Universitário do Triângulo (UNITRI). E-mail: abnunes94@gmail.com
[2] Dental Surgeon. Advanced Training in Minor Oral Surgery. Innovare. União Metropolitana para Desenvolvimento da Educação e Cultura (UNIME). E-mail: jcmoreira.ba@gmail.com

utilização tem se consolidado como estratégia eficaz para controle da ansiedade, melhora da cooperação do paciente e viabilização de procedimentos clínicos com maior conforto e segurança. Nesse contexto, sua aplicação em pacientes idosos com comorbidades representa uma alternativa relevante, especialmente em cenários que demandam abordagens menos invasivas e maior estabilidade fisiológica. O presente estudo teve como objetivo analisar a segurança e a aplicabilidade clínica do N_2O em sedação consciente nessa população por meio de uma revisão integrativa da literatura. A busca foi realizada nas bases PubMed/MEDLINE, SciELO e ScienceDirect, utilizando descritores relacionados a “nitrous oxide”, “conscious sedation”, “elderly” e “comorbidities”, sendo incluídos 12 artigos científicos. Os resultados evidenciam que o N_2O apresenta perfil de segurança consistente, especialmente quando utilizado em concentrações controladas e sob monitorização adequada, sendo os riscos clínicos mais associados às condições basais dos pacientes do que ao agente isoladamente. Alterações metabólicas, como aquelas relacionadas à vitamina B12, devem ser consideradas de forma contextualizada, particularmente em indivíduos com condições pré-existentes, não configurando, de maneira isolada, uma limitação absoluta ao seu uso. Além disso, destacam-se vantagens como manutenção da ventilação espontânea, rápida recuperação e ampla aplicabilidade clínica. Conclui-se que o N_2O representa uma estratégia viável, segura e eficaz para sedação consciente em idosos com comorbidades, desde que empregado de forma criteriosa, com avaliação individualizada e adoção de protocolos estruturados.

Palavras-chave: Óxido Nitroso. Sedação Consciente. Idosos. Comorbidades. Segurança Clínica.

RESUMEN

El óxido nitroso (N_2O) se utiliza ampliamente en la sedación consciente en entornos ambulatorios, especialmente en odontología, debido a su favorable perfil farmacológico, caracterizado por un rápido inicio de acción, fácil titulación y recuperación predecible. Su uso se ha consolidado como una estrategia eficaz para el control de la ansiedad, una mejor cooperación del paciente y la realización de procedimientos clínicos con mayor comodidad y seguridad. En este contexto, su aplicación en pacientes ancianos con comorbilidades representa una alternativa relevante, especialmente en escenarios que requieren enfoques menos invasivos y mayor estabilidad fisiológica. Este estudio tuvo como objetivo analizar la seguridad y la aplicabilidad clínica del N_2O en la sedación consciente en esta población a través de una revisión integradora de la literatura. La búsqueda se realizó en las bases de datos PubMed/MEDLINE, SciELO y ScienceDirect, utilizando descriptores relacionados con "óxido nitroso", "sedación consciente", "ancianos" y "comorbilidades", lo que resultó en la inclusión de 12 artículos científicos. Los resultados muestran que el N_2O presenta un perfil de seguridad consistente, especialmente cuando se utiliza en concentraciones controladas y bajo una monitorización adecuada, y que los riesgos clínicos están más asociados a las condiciones basales de los pacientes que al agente en sí. Las alteraciones metabólicas, como las relacionadas con la vitamina B12, deben considerarse en su contexto, particularmente en personas con afecciones preexistentes, y no constituyen, por sí solas, una limitación absoluta para su uso. Además, se destacan ventajas como el mantenimiento de la ventilación espontánea, la rápida recuperación y su amplia aplicabilidad clínica. Se concluye que el N_2O representa una estrategia viable, segura y eficaz para la sedación consciente en pacientes ancianos con comorbilidades, siempre que se utilice con criterio, con una evaluación individualizada y la adopción de protocolos estructurados.

Palabras clave: Óxido Nitroso. Sedación Consciente. Ancianos. Comorbilidades. Seguridad Clínica.

1 INTRODUCTION

Nitrous oxide (N_2O) remains one of the most widely used agents in clinical practice for conscious sedation, especially in outpatient and dental settings, due to its favorable pharmacological profile, characterized by rapid onset of action, easy titration, and predictable recovery. At subanesthetic concentrations, N_2O promotes effective sedation associated with the preservation of spontaneous ventilation and protective reflexes, characteristics that make it particularly relevant in clinical scenarios that require safety and physiological control, such as in the care of elderly patients.

Population aging has resulted in a significant increase in the demand for clinical procedures in elderly individuals, often with multiple comorbidities. This population presents important physiological changes, including reduced cardiovascular functional reserve, changes in drug metabolism, and greater neurological vulnerability. In this context, the adoption of sedation strategies that combine efficacy, predictability, and safety becomes essential. N_2O stands out as an advantageous alternative, since it has low hemodynamic impact, rapid reversibility, and good tolerability, characteristics that favor its application in patients with greater clinical complexity (PRASAD et al., 2022).

In addition, the use of N_2O in conscious sedation has been associated with improved patient cooperation, reduced anxiety, and greater comfort during procedures, contributing to the feasibility of interventions that might otherwise require more invasive techniques, such as general anesthesia. Evidence from geriatric dentistry and specialized care services indicates that N_2O can expand access to treatment in populations with physical or cognitive limitations, reducing risks associated with more complex interventions (LIM; BOYLE, 2020). The widespread use of this agent in consolidated health systems, such as the United States, reinforces its clinical viability, especially when associated with standardized protocols, adequate professional training, and continuous monitoring.

From a physiological point of view, the effects of N_2O are well characterized, including its interaction with vitamin B12 metabolism and the possible elevation of homocysteine levels (NAGELE et al., 2013; KIASARI et al., 2014). Such mechanisms should be considered in the clinical evaluation, especially in patients with pre-existing conditions, but their relevance should be interpreted in a contextualized way, since there is no consistent evidence of significant clinical impact on short-term exposures, typical of conscious sedation.

Additionally, studies conducted in elderly populations, although often in anesthetic contexts, indicate that the use of N_2O is not associated with a significant increase in neurological complications, such as delirium or cognitive decline (SPRUNG et al., 2019). These findings reinforce the understanding that the agent, when used appropriately, has a

consistent safety profile, and the clinical outcomes are more strongly influenced by the patient's baseline conditions than by the use of N_2O alone.

In view of this scenario, it is relevant to analyze the use of nitrous oxide not only from the perspective of possible limitations, but also considering its potential as an effective and widely applicable therapeutic tool. Thus, the present study aims to perform an integrative review of the literature to evaluate the safety and clinical applicability of N_2O in conscious sedation in elderly patients with comorbidities, highlighting its benefits, its feasibility and its role in contemporary clinical practice.

2 METHODOLOGY

The present study is an integrative literature review, a methodological design that allows the critical synthesis of evidence from different types of studies, maintaining analytical breadth and enabling the integration of relevant data into clinical practice. This approach was adopted considering the complexity and diversity of the available evidence on the use of nitrous oxide (N_2O) in conscious sedation in elderly patients with comorbidities.

The bibliographic search was conducted in the PubMed/MEDLINE, SciELO and ScienceDirect databases, selected for their relevance and scope in the health area. The search strategy combined controlled descriptors (MeSH) and free terms, structured with Boolean operators. An example of the strategy used in PubMed was: ("nitrous oxide" OR "N2O") AND ("conscious sedation" OR "inhalation sedation") AND ("elderly" OR "older adults" OR "aged") AND ("comorbidity" OR "chronic disease" OR "systemic disease"). Equivalent strategies were adapted for the other databases, respecting their indexing specificities.

Scientific articles published in indexed journals, available in full, that addressed the clinical use of nitrous oxide in contexts applicable to conscious sedation were included. Studies with clinical and observational designs, and reviews were considered eligible, as long as they presented data related to at least one of the following axes: elderly population, presence of comorbidities, or relevant physiological effects of N_2O. Duplicate studies, exclusively pediatric publications, articles without access to the full text, non-scientific reports, and those whose focus did not directly involve the clinical use of N_2O were excluded.

Considering the multifactorial nature of the theme and the need to broaden the understanding of its clinical aspects, indirect evidence was included through previously defined criteria. Studies investigating the use of N_2O in anesthetic settings or in populations that were not exclusively elderly were considered indirect evidence, as long as they presented physiological, metabolic, cardiovascular, or neurological outcomes with potential

applicability to the context of conscious sedation in older adults with comorbidities. The inclusion of this evidence was conditioned on the presence of relevant pathophysiological mechanisms or on the explicit discussion of clinical factors related to the target population.

The selection process of the studies was carried out in three sequential stages: initial screening by titles, evaluation of abstracts and complete reading of eligible texts. In each stage, the previously established inclusion and exclusion criteria were applied. At the end of the process, 12 scientific articles considered relevant to the theme were included, prioritizing those with greater clinical relevance and methodological consistency.

Data analysis was conducted qualitatively, with organization of findings into thematic axes defined based on the study objectives and the recurrence of the outcomes identified in the literature. The main axes included: clinical safety of N_2O, physiological and metabolic effects, implications in patients with comorbidities, and applicability in the context of conscious sedation. The thematic categorization was carried out through comparative analysis of the results of the studies, allowing the identification of consistent patterns, variations between findings, and aspects relevant to clinical practice. This approach enabled a structured and applied synthesis, in line with the objective of evaluating the role of N_2O as a safe and effective strategy in conscious sedation.

3 RESULTS AND DISCUSSION

The analysis of the included studies shows that nitrous oxide has a broadly favourable safety profile when used in conscious sedation settings, especially at controlled concentrations and under adequate monitoring. Systematic reviews have shown a low incidence of serious adverse events associated with the use of N_2O, which in most cases are mild and self-limited (COLLADO et al., 2007). Although some of this evidence derives from heterogeneous populations, the findings consistently contribute to the consolidation of N_2O as a safe and widely used agent in clinical practice.

In the context of elderly patients, studies conducted in anesthetic settings indicate that the use of N_2O is not associated with a significant increase in neurological complications, such as delirium or cognitive decline (LEUNG et al., 2006; SPRUNG et al., 2019). These results, although often derived from general anesthesia settings, offer relevant support for the understanding that N_2O, when used appropriately, does not constitute a significant independent risk factor. Additional evidence indicates that patient-related factors, such as advanced age, presence of neurodegenerative diseases, and systemic comorbidities, play a more decisive role in clinical outcomes than the sedative agent alone (MANIACI et al., 2025).

The physiological and metabolic effects of N_2O, particularly those related to vitamin B12 inactivation and increased homocysteine levels, are well described in the literature (NAGELE et al., 2013; KIASARI et al., 2014). However, the clinical relevance of these effects should be interpreted in light of the context of use, since most studies demonstrate biochemical changes without direct correspondence with significant clinical adverse events, especially in short-term exposures, as occurs in conscious sedation. Thus, such effects should be understood as conditional factors, especially relevant in patients with pre-existing disabilities or specific clinical conditions.

In addition, recent reviews highlight that vitamin deficiency states may act as predisposing factors for complications in anesthetic contexts (MOGHADDAM et al., 2025). In this sense, prior clinical evaluation plays a fundamental role in the identification of potentially susceptible patients. Clinical reports also describe cases of neuropathy associated with long-term exposure to N_2O (EGAN; STEINBERG; ROSE, 2018), reinforcing the importance of considering the duration and context of use, without compromising its use in controlled protocols of conscious sedation.

The presence of comorbidities is a central element in the assessment of clinical risk in elderly patients. Studies indicate that conditions such as cardiovascular, metabolic, and neurological diseases have a greater association with adverse outcomes than the use of anesthetic agents alone (KINUGAWA et al., 2017). In this context, N_2O should be interpreted as part of an integrated clinical approach, in which preoperative assessment, risk stratification, and appropriate monitoring play a decisive role in the safety of the procedure. Evidence from geriatric dentistry demonstrates that the implementation of structured assessment protocols contributes significantly to the reduction of complications and improvement of clinical outcomes (PRASAD et al., 2022).

From the point of view of clinical applicability, N_2O has relevant advantages that justify its wide use in outpatient settings. Among its main benefits are the rapid onset of action, ease of titration, predictable recovery, and maintenance of spontaneous ventilation, characteristics that are particularly important in elderly patients and those with comorbidities. In addition, its use is associated with improved patient cooperation, reduced anxiety, and greater comfort during procedures (LIM; BOYLE, 2020).

Observational studies also indicate a positive impact on clinical and operational parameters, including recovery time and post-procedure stability (OBEIDAT et al., 2021). The experience accumulated in different health systems, especially in countries such as the United States, reinforces the viability of N_2O as a safe and effective strategy, as long as it is

inserted in well-established protocols, with adequate professional training and continuous monitoring.

Thus, although the literature still has limitations regarding the availability of studies specifically targeting the elderly population with comorbidities in the context of conscious sedation, the body of available evidence consistently supports the use of N_2O as a safe, effective, and widely applicable alternative. Its use, when based on well-defined clinical criteria and individualized evaluation, represents a relevant strategy for performing outpatient procedures with greater safety, predictability, and comfort for the patient.

4 CONCLUSION

The present integrative review demonstrates that nitrous oxide has a consistent safety profile and broad applicability in conscious sedation, including in elderly patients with comorbidities. The findings indicate that, when used in appropriate concentrations and under appropriate monitoring, N_2O maintains favorable characteristics, such as fast action, easy titration, predictable recovery, and preservation of spontaneous ventilation, contributing to the performance of procedures with greater safety and comfort.

The physiological effects associated with its use, particularly those related to the metabolism of vitamin B12, should be considered within an individualized clinical context, especially in patients with pre-existing conditions, and do not constitute, in isolation, an absolute limitation to its use. Likewise, the presence of comorbidities should be interpreted as a factor in the modulation of clinical risk, reinforcing the importance of prior evaluation and the adoption of structured protocols.

The wide use of N_2O in different care contexts and its consolidation in health systems with a high level of organization reinforce its viability as a safe and effective strategy in conscious sedation. In this sense, N_2O represents a relevant tool in contemporary clinical practice, especially in populations that demand less invasive and more predictable approaches.

Thus, it is concluded that the use of nitrous oxide in conscious sedation in elderly people with comorbidities is not only feasible, but also clinically advantageous, as long as it is conducted judiciously, based on individualized evaluation and adequate monitoring.

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