Nitrous Oxide: An Alternative to Epidural Analgesia in Labor

Destiny Romano

Margaret H Rollins School of Nursing

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Dr. D. Blankenship

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Labor pain is one of the most intense forms of pain a woman can experience, and having effective pain management can make all the difference. Epidural analgesia is one of the main forms of pain management in labor, although not everyone can be candidates for this option. In recent years, nitrous oxide (N2O), also known as “laughing gas,” has gained attention as an alternative option for managing labor pain. Studies show that nitrous oxide provides moderate pain relief, allows for mobility, and gives women a greater sense of control during childbirth (Bradfield et al., 2023). Compared to epidural analgesia, it has a quicker onset, fewer medical contraindications, and minimal effects on the progress of labor or the fetus (Hoffman et al., 2021). The use of nitrous oxide in labor can offer a safe alternative to epidural analgesia, while nurses help educate, monitor, and support patients to ensure optimal outcomes.

Background and History

The use of nitrous oxide for vaginal delivery has progressed and evolved over the years to provide optimal safety when it is used. The first reported use of nitrous oxide for vaginal delivery was in 1881, by Polish physician Klikovich using an 80% N2O/20% oxygen mixture (Broughton et al., 2020). Although nitrous oxide has been used for over a century, there has been many changes in the way it is delivered. After quite some time of use, it was withdrawn due to the delivery of a hypoxic mixture. After multiple revisions to the analgesia, the British began using a fixed concentration of 50% N2O/50% O2 called Entonox-in 1961 (Broughton et al., 2020). Improvements in gas ratios, equipment and monitoring have made nitrous oxide much safer to administer, therefore leading to its return in modern obstetric care. Nitrous oxide has become a meaningful option for labor analgesia in the United States because it provides a non-invasive and patient controlled pain relief method.

Mechanism of action

Unlike, epidural anesthesia, nitrous oxide is self-administered through a mask, allowing women to inhale controlled amounts at her own will, granting pain management autonomy. Nitrous oxide works through both pain-relieving and anti-anxiety pathways. Its analgesic action is thought to involve spinal cord neuromodulators, much like opioid medications, which is why it can make contractions feel more manageable. At the same time, it produces a calming effect similar to benzodiazepines by acting on GABA-A receptors. The anesthetic properties are also linked to activity at GABA-A and NMDA receptors (Mukhopadhyay et al., 2021). Furthermore, nitrous oxide acts quickly once inhaled and reaches its peak effect in under a minute, which is why women often feel rapid relief, reduced anxiety, and a sense of relaxation. In the same sense, the medication clears from the body just as fast, usually within a couple of minutes after stopping inhalation (Hoffman et al., 2021). While the use of nitrous oxide does not completely eliminate pain, these combined mechanisms help decrease the intensity of contractions so labor can become more tolerable.

Evidence based research

Recent research has shown that nitrous oxide is a safe and practical option for labor analgesia, however, it does not completely eliminate pain the way an epidural can. In a randomized controlled trial, Mukhopadhyay et al. (2021) found that women who used Entonox reported noticeable pain relief and high satisfaction during labor, without major complications. Maternal experiences also continue to be important when evaluating pain management. Bradfield et al. (2023) found that women described nitrous oxide as “helpful in reducing anxiety and making contractions more manageable,” and that it allowed them to stay present and in control during labor. Many women value comfort, mobility, and control just as much as pain reduction.

Studies show that nitrous oxide helps reduce anxiety and supports a calmer labor experience, therefore showing overall satisfaction with nitrous oxide remains consistently high. Research shows that about three-quarters of women who use nitrous oxide during labor reported being satisfied with their pain relief, especially those who preferred a less invasive option (Bonarska et al., 2025). Research on neonatal outcomes also remains reassuring. Starosta et al. (2024) studies show infants born to mothers who used nitrous oxide reported no significant differences in Apgar scores or NICU admissions when compared to births without nitrous oxide. Their findings support that nitrous oxide has no measurable negative effects on newborns when used briefly during labor. Hoffman et al. (2021) reported the same pattern, stating that nitrous oxide use "was not associated with adverse neonatal outcomes," and that Apgar scores and NICU admissions were comparable to patients who did not receive it (Hoffman et al., 2021). Even though nitrous oxide crosses the placenta, it does not remain in the infant's system. Broughton et al. (2020) explained that after birth, the gas is quickly cleared as soon as the baby begins breathing on their own. Levels of nitrous oxide drop rapidly within minutes since it does not accumulate in neonatal tissues. These findings show no evidence of harmful short-term effects. While some patients may eventually request additional analgesia, nitrous oxide is still an effective first-line option with minimal maternal or neonatal risks. Overall, these findings support that modern nitrous oxide systems offer moderate pain relief, high maternal satisfaction, and safe outcomes for both mother and baby.

Significance of the Topic

The growing interest in nitrous oxide during labor is significant because if offers women a non-invasive, fast-acting, and self-controlled method of pain relief. Many laboring patients want options that allow mobility and a sense of control, which is one of the major reasons nitrous

oxide has made an appearance in obstetric practice. Several recent reviews note that U.S. hospitals and birth centers have increasingly reintroduced nitrous oxide after many years due to the demand for mobility and autonomy over pain management (Hoffman et al., 2021). Recent research also shows nitrous oxide use is more common globally than previously thought. In Australia, over 50% of laboring women use nitrous oxide for analgesia (Bradfield et al., 2023). In the United States, Hoffman et al., (2021) reported that use has increase in recent years as modern, self-administered delivery systems became more widely available, therefore making it a more accessible option for patients seeking non-invasive pain control. This increase is clinically significant because while epidural analgesia is highly effective, it may not be appropriate for every laboring patient. Common contraindications include thrombocytopenia, certain coagulation disorders, spinal abnormalities, or situations in which anesthesia staff are unavailable (Bradfield et al., 2023). In contrast, nitrous oxide has fewer contraindications and does not require anesthesia placement or continuous monitoring. Nitrous oxide may also be beneficial in circumstances where patients want to avoid the motor block or the limited mobility that comes with epidurals. Because of these differences in safety factors, autonomy, and accessibility, nitrous oxide can be a practical option for labor pain management.

Furthermore, the increased use of nitrous oxide during labor has a meaningful effect on nursing practice and patient care. For nurses, nitrous oxide requires training in safe administration, equipment setup, and patient education, however it is far less labor-intensive than epidural analgesia (Broughton et al., 2020). Since it is self-administered, nurses can focus on labor support and maternal comfort rather than having to manage invasive procedures. Evidence also shows that nitrous oxide provides great pain reduction and minimal maternal or fetal side effects, which strengthens confidence in its use at the bedside (Mukhopadhyay et al., 2021). This

research helps reassure patients who worry about safety because Starosta et al. (2024) found no increase in NICU admission, Apgar concerns, or need for respiratory support among infants exposed to intrapartum nitrous oxide. In addition, Bonarska et al. (2025) highlighted that nitrous oxide supports patient-centered care because women can remain upright, change positions, and can decide when they want to discontinue it. Together, this research shows that nitrous oxide expands options for safe, flexible labor analgesia and allows nurses to give their patients greater control over their birthing experience.

Conclusion

In conclusion, current research supports that nitrous oxide is a safe, accessible and patient-centered option for labor pain management. Even though it does not eliminate pain to the extent of an epidural, it can provide meaningful pain relief, decrease anxiety, and it can help laboring women remain mobile and in control. Evidence from clinical trials demonstrate that maternal side effects are typically mild and show no neonatal side effects. These findings make it a reassuring alternative for patients who are not candidates for epidural analgesia or who prefer a less invasive option. This option of pain management also influences nursing practice as nurses play a key role in educating, monitoring, and supporting women during self-administration. Understanding the evidence behind its safety and effectiveness, nurses can confidently offer nitrous oxide as part of evidence-based care. As the demand for non-invasive and flexible pain management grows, nitrous oxide can provide another pathway to provide safe, satisfying, and patient-centered childbirth.

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