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PAIN MANAGEMENT IN LABOR: A LITERATURE REVIEW COMPARING ANESTHETIC AND NON- PHARMACOLOGICAL TECHNIQUES

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Abstract: Objectives: The aim of this literature review is to critically compare the effectiveness, safety, and overall outcomes of anesthetic and non-pharmacological techniques for labor pain management. The review also explores maternal satisfaction and labor outcomes associated with these pain management approaches, with the goal of providing evidence-based recommendations for clinical practice. **Methods:** A systematic search of the literature was conducted using databases such as PubMed, Cochrane Library, and Medline. Studies were selected based on pre-defined inclusion criteria, including randomized controlled trials, cohort studies, and systematic reviews published between 2010 and 2023. Keywords such as “labor pain,” “anesthetic techniques,” “non-pharmacological techniques,” and “maternal outcomes” were used. A total of 14 studies were included in the review, focusing on the comparison between anesthetic methods like epidural and spinal analgesia and non-pharmacological approaches such as hydrotherapy, acupuncture, and TENS. **Results:** Anesthetic techniques, particularly epidural analgesia, consistently demonstrated superior pain relief throughout labor, with most studies highlighting its efficacy in reducing labor pain and improving maternal comfort. However, some studies indicated a higher incidence of instrumental deliveries and prolonged second-stage labor in epidural users. Non-pharmacological techniques, while less potent in pain relief, offered additional benefits such as reduced medical intervention rates and greater maternal autonomy. Techniques like hydrotherapy and acupuncture were noted to have favorable impacts on maternal satisfaction and fewer side effects compared to systemic opioid use or continuous epidural infusion. **Conclusion:** Both anesthetic and non-pharmacological pain management methods have their distinct

advantages and limitations. Anesthetic techniques, especially epidurals, provide robust pain relief but may be associated with higher rates of medical intervention. Non-pharmacological methods, although less effective in pain relief, offer a more holistic and low-risk approach to labor management. Personalized, patient-centered approaches that combine both types of techniques may yield the best outcomes, improving both pain relief and maternal satisfaction. Future research should focus on optimizing combined pain management strategies and exploring new non-pharmacological techniques.

Keywords: Labor pain management; Anesthetic techniques; Non-pharmacological methods; Maternal outcomes; Epidural analgesia.

INTRODUCTION

Labor pain is a complex and multifaceted experience, recognized as one of the most intense types of pain that women may face in their lifetime. The effective management of this pain is critical, not only to alleviate physical discomfort but also to ensure psychological well-being and positive birth outcomes. As maternal healthcare continues to advance, the management of labor pain has become a major focus of both clinical practice and research, leading to the development of a wide range of pain relief strategies. These include both pharmacological interventions, such as anesthetic techniques, and non-pharmacological approaches, each with its own set of advantages and limitations.

Pharmacological techniques, particularly the use of epidural analgesia, have become the cornerstone of pain management in labor for many women. Epidural analgesia offers significant pain relief, allowing women to remain conscious and active participants in the birth process. However, despite its widespread use, epidurals are associated with certain risks, including maternal hypotension,

prolonged labor, increased likelihood of assisted deliveries, and potential side effects like fever and motor blockade. These concerns have led some women and healthcare providers to explore alternative methods.

Non-pharmacological techniques, on the other hand, have gained increased attention as a more holistic approach to labor pain management. These methods include water immersion, massage, acupuncture, acupressure, breathing techniques, and continuous labor support. While these strategies often promote greater maternal autonomy and involve fewer medical interventions, their effectiveness in providing significant pain relief has been the subject of ongoing debate. Many non-pharmacological techniques aim to enhance the psychological and emotional aspects of labor by helping women manage pain through relaxation, movement, and supportive care, but they may not provide the same level of relief as pharmacological interventions in all cases.

As labor pain management evolves, a growing body of literature has emerged comparing the effectiveness, safety, and outcomes of anesthetic and non-pharmacological methods. This literature review aims to synthesize findings from a wide range of studies to provide a comprehensive overview of the current state of knowledge on these two approaches. By examining the strengths and limitations of both pharmacological and non-pharmacological techniques, this review seeks to inform healthcare providers, researchers, and expectant mothers about the most effective strategies for managing labor pain in different contexts.

The review will focus on key areas of comparison, including the efficacy of pain relief, maternal satisfaction, obstetric outcomes, and potential side effects for both mother and newborn. Through this analysis, we aim to provide a clearer understanding of how different pain management strategies impact

the childbirth experience, with the goal of supporting informed decision-making and enhancing the quality of maternal care. In doing so, this review will contribute to the broader conversation about optimizing pain management during labor and balancing the diverse needs and preferences of women in childbirth.

OBJECTIVES

The primary objective of this literature review is to critically examine and compare the efficacy, safety, and overall impact of anesthetic techniques, such as epidural analgesia, with non-pharmacological methods, including relaxation techniques, water immersion, massage, and acupuncture, in the management of labor pain. By synthesizing evidence from a diverse range of studies, this review seeks to provide a comprehensive understanding of how these two categories of pain management strategies influence maternal and neonatal outcomes.

In addition to comparing efficacy, this review will also explore maternal satisfaction and how different pain management techniques affect women's overall childbirth experience, particularly in relation to pain control, emotional well-being, and perceived autonomy during labor. Furthermore, the review will analyze labor outcomes, such as the duration of labor, the need for instrumental deliveries, and the rate of cesarean sections, with the aim of understanding how each method influences these critical factors.

Lastly, a key component of this review is to evaluate the safety profiles of both anesthetic and non-pharmacological approaches, particularly focusing on the frequency and severity of side effects for both mothers and newborns. This will include examining potential complications such as maternal hypotension, motor blockade, and neonatal outcomes, thus offering a balanced perspective

on the risks and benefits associated with each technique. Through this comprehensive comparative analysis, the review seeks to provide valuable insights for healthcare professionals and expectant mothers, promoting informed decision-making that considers efficacy, safety, and personal preferences in labor pain management.

METHODOLOGY

To ensure a comprehensive and unbiased review, a systematic literature search was conducted across multiple electronic databases, including PubMed, Cochrane Library, MEDLINE, Embase, and CINAHL. The search strategy utilized a combination of Medical Subject Headings (MeSH) and free-text terms, including keywords such as "labor pain management," "epidural analgesia," "non-pharmacological techniques," "anesthetic methods," "maternal satisfaction," "labor outcomes," "pain relief in labor," and "non-epidural approaches." The search was limited to studies published between 2005 and 2024 to ensure the inclusion of the most up-to-date evidence. Reference lists of relevant studies and reviews were also manually screened to identify additional sources.

INCLUSION AND EXCLUSION CRITERIA

Studies were selected based on predefined inclusion and exclusion criteria. To be eligible for inclusion, studies had to meet the following criteria: (1) randomized controlled trials (RCTs), cohort studies, or meta-analyses that examined the efficacy or safety of anesthetic or non-pharmacological techniques for labor pain management; (2) studies that reported on maternal or neonatal outcomes, including satisfaction with pain relief, labor duration, cesarean or instrumental delivery rates, or side effects; (3) studies published in English; and (4) studies involving healthy

pregnant women without contraindications for either anesthetic or non-pharmacological interventions. Exclusion criteria included studies focusing solely on pharmacological interventions unrelated to labor pain (e.g., opioid-based methods), studies that did not involve human participants, and studies where full-text access was unavailable.

STUDY ANALYSIS

Data extraction was performed by reviewing the full texts of the selected studies, and relevant information was recorded, including study design, sample size, methods of pain management, primary outcomes, and conclusions. A qualitative synthesis was used to describe trends in the efficacy, safety, and satisfaction associated with both anesthetic and non-pharmacological techniques. When quantitative data was available, it was summarized and compared using appropriate statistical measures, such as risk ratios or mean differences. In cases where meta-analyses were available, these were incorporated to enhance the reliability of findings. The review also considered the quality of the included studies, assessing factors such as the risk of bias, sample representativeness, and study limitations.

LITERATURE REVIEW

LABOR PAIN: PHYSIOLOGY AND PERCEPTION

Labor pain is a complex and multidimensional experience, influenced by various physiological, psychological, and cultural factors. During the first stage of labor, pain arises primarily from uterine contractions and cervical dilation, leading to the activation of visceral nociceptors. This visceral pain is typically localized to the lower abdomen, transmitted through the T10 to L1 spinal nerves. As labor progresses to the second stage, somatic pain becomes more pronounced due to the stret-

ching and distention of the pelvic floor, vagina, and perineum, involving the S2 to S4 nerve roots (^{1, 2}).

Perception of labor pain varies widely among women, shaped by individual psychological factors such as fear, anxiety, and previous childbirth experiences. Women who experience high levels of anxiety or fear often report higher pain intensity, likely due to the central nervous system's heightened sensitivity to nociceptive signals in response to emotional stress (^{3, 4}). Additionally, personal coping mechanisms, social support, and preparation for childbirth, such as attending childbirth education classes, play significant roles in modulating the perception of pain and overall satisfaction with the labor process (^{5, 6}).

Cultural factors also significantly influence how labor pain is perceived and managed. In some cultures, labor pain is viewed as a natural and integral part of the birthing experience, with less emphasis on medical intervention. In contrast, other societies prioritize active pain relief methods, with a focus on minimizing discomfort (⁷). Studies have shown that women who receive adequate psychological preparation for labor tend to report lower pain intensity and higher satisfaction with the birthing experience, highlighting the importance of addressing psychological as well as physical aspects of pain (^{8, 9}).

ANESTHETIC TECHNIQUES

Anesthetic techniques for labor pain management are among the most effective and widely used options, particularly in modern obstetric care. The three main anesthetic methods employed during labor are epidural analgesia, spinal analgesia, and systemic analgesia. Each technique offers distinct benefits and potential risks, which influence maternal outcomes and the overall labor experience.

Epidural analgesia remains one of the most effective and widely used methods for mana-

ging labor pain, offering significant relief while allowing the mother to remain conscious and alert throughout labor (^{6, 10}). One key advantage of this technique is its ability to provide continuous pain relief, which can be adjusted as labor progresses, ensuring that pain management is responsive to the changing needs of the patient (^{8, 11}). Epidurals are commonly administered using a continuous infusion or patient-controlled epidural analgesia (PCEA), which allows women to regulate the amount of anesthetic they receive (^{10, 11}).

However, epidurals are not without risks. Studies have shown that while epidural analgesia does not significantly increase cesarean section rates, it is associated with a higher incidence of instrumental vaginal deliveries, such as forceps or vacuum-assisted births (^{6, 12}). Additionally, there is an ongoing debate about whether epidurals prolong the second stage of labor, potentially leading to more interventions such as oxytocin augmentation (^{8, 14}). Other common side effects include hypotension, motor blockade, and fever, though most of these are manageable and reversible (^{12, 13}).

Spinal anesthesia, often used for cesarean deliveries, provides rapid and effective pain relief with a single injection into the spinal fluid. Combined spinal-epidural (CSE) techniques offer the advantages of both approaches—rapid onset of pain relief from the spinal component and sustained analgesia from the epidural catheter (^{6, 14}). These methods are particularly useful in cases where labor is progressing quickly or when a cesarean section becomes necessary.

Systemic analgesia, including opioids like fentanyl or remifentanyl, offers an alternative for women who cannot or choose not to receive epidural analgesia. While these drugs are effective at reducing pain, they come with side effects such as nausea, drowsiness, and respiratory depression, which can affect

both the mother and the newborn (^{9, 14}). Additionally, systemic opioids may influence early mother-infant bonding due to their sedative effects on the mother, and in some cases, the neonate (^{11, 13}). However, they remain an essential option in low-resource settings where epidural or spinal anesthesia may not be available (^{9, 12}).

Epidural analgesia is the most common and widely studied form of pain relief during labor, often considered the gold standard for pain management. It involves the injection of a local anesthetic, often combined with an opioid, into the epidural space to block pain signals from the lower spinal nerves. This technique provides effective pain relief throughout labor and allows the mother to remain conscious and alert (^{6, 10}). One of the significant advantages of epidural analgesia is its ability to provide continuous pain relief, which can be adjusted as labor progresses (^{8, 11}).

However, epidurals are associated with certain risks, including maternal hypotension, fever, and prolonged second stage of labor, which may lead to an increased likelihood of instrumental delivery (^{5, 10, 11}). In some cases, epidural analgesia has also been linked to a higher incidence of motor blockade, urinary retention, and the need for oxytocin augmentation to maintain labor progression (^{5, 6}). Despite these potential risks, studies have shown that epidurals do not significantly increase the risk of cesarean section, although they are associated with a higher rate of assisted vaginal deliveries (^{8, 12}).

Spinal analgesia involves the injection of local anesthetic into the cerebrospinal fluid, providing faster and more profound pain relief compared to epidural analgesia. It is commonly used in combination with an epidural in a technique called combined spinal-epidural (CSE) analgesia, which allows for the rapid onset of pain relief provided by spinal anesthesia while maintaining the

longer-duration benefits of an epidural. This combination is particularly effective for early labor and for ensuring consistent pain relief during both the first and second stages of labor (6, 11). Spinal analgesia is especially beneficial for women with contraindications to systemic opioids or those who require faster pain control due to rapid labor progression (7, 13).

While spinal analgesia provides faster relief, it can cause side effects such as headaches (post-dural puncture headache), hypotension, and in rare cases, transient neurological symptoms. The combined spinal-epidural technique has been shown to offer superior maternal satisfaction compared to spinal or epidural alone, as it offers rapid onset with fewer side effects (12, 13).

Systemic analgesia refers to the use of opioids and other medications administered intravenously or intramuscularly to manage labor pain. Unlike regional anesthetic techniques such as epidural or spinal analgesia, systemic analgesia acts on the central nervous system, providing generalized pain relief rather than targeted blockade of pain signals from the lower spinal nerves. Common systemic analgesics used in labor include opioids like fentanyl, meperidine, and remifentanyl, as well as non-opioid alternatives such as nitrous oxide (8, 13).

Opioids are often used when regional techniques are not feasible or desired, or during the earlier stages of labor before epidural placement. However, while they offer moderate pain relief, systemic opioids are less effective than epidurals in controlling labor pain and may produce side effects such as nausea, vomiting, sedation, and respiratory depression in both the mother and neonate (9, 12). Moreover, opioids can cross the placenta, which raises concerns about neonatal respiratory depression and altered Apgar scores immediately after birth (7, 13).

Remifentanyl, a short-acting opioid with a rapid onset and elimination, has gained attention as an alternative to traditional opioids due to its relatively reduced risk of maternal sedation and neonatal respiratory depression. However, remifentanyl requires careful monitoring due to the potential for maternal respiratory depression, especially in high doses (8, 12). Nitrous oxide is another option for systemic pain relief, offering minimal interference with labor progression and a rapid onset, although it provides weaker pain relief compared to opioids or regional anesthesia (10, 11).

Recent advancements in anesthetic techniques have led to the development of newer methods aimed at optimizing pain control while minimizing side effects. One such technique is the programmed intermittent epidural bolus (PIEB) method, which provides scheduled boluses of anesthetic instead of a continuous infusion, leading to more effective analgesia with a reduced total dose of medication (11, 14). Studies have shown that PIEB is associated with improved maternal satisfaction, less motor blockade, and potentially fewer interventions compared to traditional continuous epidural infusion techniques (7, 14).

Another innovation in anesthetic approaches is the use of patient-controlled epidural analgesia (PCEA), which allows the laboring woman to self-administer boluses of anesthetic as needed. PCEA has been associated with increased maternal control and satisfaction, as well as a reduced total dose of local anesthetic and opioid, compared to fixed-rate infusions (13, 14). This technique is particularly beneficial in maintaining a balance between effective pain relief and minimal motor impairment, contributing to better maternal mobility during labor (8, 12).

Long-term Effects on Maternal and Neonatal Outcomes: While the short-term efficacy of epidural and systemic analgesia is well-established, potential long-term effects warrant consideration. Some studies suggest that epidurals might prolong labor or lead to higher rates of instrumental deliveries, though the evidence remains mixed (6, 12). Systemic opioids, though effective in pain management, might influence early mother-infant bonding due to sedation effects on both the mother and the newborn (11, 14).

Individualized Pain Management: Labor pain management must be tailored to individual needs. Women with certain preexisting conditions, such as low platelet counts, spinal abnormalities, or other contraindications, may not be suitable candidates for epidural or spinal anesthesia. In these cases, systemic analgesia or non-pharmacological techniques may be better suited to the patient's condition (8, 13).

Global Disparities in Access: While techniques like epidurals and PCEA are widely available in high-income countries, access to such pain management options is often limited in low-resource settings. In these regions, systemic opioids may still dominate labor pain management, emphasizing the need for more accessible and effective options that can offer pain relief without requiring advanced infrastructure or anesthesia services (9, 12).

NON-PHARMACOLOGICAL TECHNIQUES

Non-pharmacological techniques for labor pain management have gained significant attention in recent years as women seek more natural, less invasive methods of coping with the intense discomfort of labor. These approaches appeal to those who prefer to avoid or minimize medical interventions, offering a range of methods that can be tailored to individual preferences and circumstances. Non-pharmacological strategies include breathing

techniques, hydrotherapy, acupuncture, and Transcutaneous Electrical Nerve Stimulation (TENS), among others. Each of these methods has distinct mechanisms and varying degrees of effectiveness, safety, and impact on labor outcomes.

Breathing techniques, often taught as part of childbirth education programs like Lamaze or the Bradley Method, focus on helping women manage labor pain by controlling their breath and promoting relaxation. The use of specific breathing patterns can reduce anxiety and provide a sense of control during labor, thus helping to lower the perception of pain (12, 13). Studies suggest that while breathing techniques alone may not eliminate labor pain, they can significantly reduce its intensity and improve maternal satisfaction with the birth experience (8, 10). Additionally, controlled breathing can help reduce the body's stress response, which may positively influence labor progression (9, 13).

Hydrotherapy, or the use of warm water immersion during labor, is another popular non-pharmacological pain management method. It is typically offered in birthing centers or hospitals equipped with laboring tubs. The warm water helps to relax the muscles, reduce tension, and provide buoyancy, which can relieve pressure on the body and reduce pain sensations (6, 11). Research has shown that hydrotherapy is associated with a reduction in the use of epidurals and other pain medications during labor (12, 14). Moreover, it may contribute to shorter labor duration and increased maternal satisfaction (10, 13). Importantly, hydrotherapy has been found to be safe for both the mother and baby when used appropriately, with no increase in adverse outcomes such as infection or neonatal complications (6, 11).

Acupuncture, a practice rooted in traditional Chinese medicine, involves the insertion of fine needles into specific points on the body

to relieve pain. It is believed to stimulate the release of endorphins and other neurochemicals that modulate pain perception (^{8, 12}). Acupuncture has been increasingly explored as a non-pharmacological option for labor pain management. Several studies have demonstrated its potential to reduce pain intensity and decrease the need for epidural analgesia (^{9, 13}). Although the evidence supporting acupuncture's efficacy in labor is still emerging, it is generally regarded as safe, with minimal side effects when performed by a trained practitioner (^{10, 11}). Some women report a greater sense of well-being and relaxation during labor when acupuncture is used (^{13, 14}).

TENS is a technique that involves the use of electrical impulses delivered through electrodes placed on the skin to alleviate pain. The electrical stimulation is thought to interfere with the transmission of pain signals to the brain by activating the body's natural pain-relief mechanisms (^{8, 13}). TENS has been used in labor as a non-invasive method to reduce the intensity of pain, particularly in the early stages (^{9, 12}). While some studies report that TENS can effectively reduce pain and increase maternal satisfaction, its overall efficacy in managing labor pain remains a topic of debate (^{6, 13}). It is a safe option with minimal side effects, though its effectiveness may vary depending on the individual and the stage of labor (^{12, 13}).

The effectiveness of non-pharmacological pain management techniques varies widely depending on the individual, the method used, and the stage of labor. Breathing techniques and hydrotherapy are particularly effective in early labor, helping to reduce anxiety and moderate pain (^{10, 12}). Acupuncture and TENS may offer more targeted pain relief, but their success largely depends on correct application and timing (^{6, 13}). Importantly, non-pharmacological methods often complement pharmacological techniques, allowing women to use these strategies in combination to achieve optimal pain relief (^{8, 14}).

Moreover, non-pharmacological methods are associated with fewer medical interventions and reduced use of anesthesia, which may lead to improved maternal outcomes such as shorter labor, fewer instrumental deliveries, and enhanced maternal satisfaction (^{11, 13}). However, one of the limitations of non-pharmacological techniques is that they generally do not provide complete pain relief and may not be sufficient in more intense phases of labor (^{9, 12}). Nonetheless, these techniques offer a valuable alternative or supplement to medical pain management, empowering women to take an active role in their labor experience.

COMPARATIVE INSIGHTS FROM THE LITERATURE

The comparison between anesthetic and non-pharmacological methods for labor pain management is a central theme in obstetric care, with studies offering rich insights into their respective benefits and limitations. Each method brings distinct advantages, yet the literature suggests that neither can fully address the multifaceted nature of labor pain management alone. The exploration of pain relief efficacy, maternal satisfaction, and labor outcomes reveals the complexity of choosing the most suitable approach for each individual case.

Pain Relief – A Matter of Intensity and Expectations: The primary advantage of anesthetic techniques, especially epidural analgesia, lies in their unparalleled ability to alleviate intense labor pain. Studies consistently show that epidurals provide superior pain control compared to non-pharmacological methods (^{10, 12}). Women who receive epidurals report significantly lower pain scores, especially during the active and transitional phases of labor, when contractions become most intense (^{8, 13}). This is a crucial consideration in cases of prolonged labor, or when medical complications necessitate minimal stress on the mother, such as in hypertensive pregnancies (⁶).

However, pain relief is not a linear measure of maternal satisfaction. Non-pharmacological methods like hydrotherapy, acupuncture, and breathing techniques offer moderate pain relief, but their impact goes beyond simply mitigating physical discomfort. These techniques engage psychological and emotional factors, enhancing a woman's sense of control, autonomy, and emotional resilience during labor (13). For many women, particularly those with a strong preference for natural childbirth, the self-efficacy fostered by non-pharmacological techniques compensates for the incomplete pain relief (8, 12). In some studies, women who used non-pharmacological techniques reported high levels of satisfaction despite higher pain scores, as these methods aligned more closely with their expectations for a natural and less medicalized labor (7, 11).

Maternal Satisfaction: Interestingly, the correlation between effective pain relief and maternal satisfaction is not as straightforward as one might assume. Anesthetic methods, though highly effective in mitigating pain, sometimes fall short in delivering overall maternal satisfaction. Women who opt for epidural analgesia, for example, often report mixed feelings post-labor. While the physical relief is immediate and substantial, some experience dissatisfaction with the reduced mobility, perceived loss of control, or a sense of passivity induced by the epidural (10, 13). Moreover, epidurals can inadvertently shift the course of labor by necessitating additional interventions, such as oxytocin augmentation or instrumental deliveries, which may further detract from the mother's overall experience (6, 11).

In contrast, women who engage with non-pharmacological methods often describe their labor experience in terms of empowerment and personal achievement, even when their pain was not fully alleviated (7, 12). Studies indicate that women who choose techniques

such as breathing exercises, TENS, or water immersion tend to be more actively involved in their labor, contributing to higher levels of satisfaction related to their sense of agency (6, 12, 14). This is particularly true in scenarios where the laboring woman places a strong emphasis on emotional and psychological factors, valuing an active participation in the process over complete pain suppression (9, 12).

Labor Outcomes: The impact of these pain management strategies extends beyond the subjective experience of pain relief and satisfaction to the objective outcomes of labor itself. Epidural analgesia, while highly effective in controlling pain, is associated with longer second stages of labor, potentially leading to an increased use of instrumental delivery methods such as forceps or vacuum extraction (8, 11). While these outcomes are not inherently negative, they do suggest that epidurals might increase the likelihood of a more medicalized birth process, which could counteract some women's preferences for minimal intervention (10, 13).

Non-pharmacological techniques, on the other hand, tend to support a more physiological progression of labor. Studies indicate that women who utilize methods such as acupuncture, hydrotherapy, or movement-based strategies are less likely to require medical interventions (12, 14). For example, a comprehensive review revealed that non-pharmacological methods were linked to lower rates of cesarean sections and instrumental deliveries (6, 11). Moreover, the absence of motor blockade allows women greater freedom of movement during labor, which may contribute to more effective pushing and shorter second-stage durations (9, 13). However, the trade-off for this less interventionist approach is often less complete pain relief, which can be challenging for women whose labor is particularly prolonged or complicated (8, 12).

INTEGRATED APPROACHES: THE BEST OF BOTH WORLDS?

An emerging body of literature advocates for a hybrid approach to labor pain management, combining the strengths of both anesthetic and non-pharmacological methods. Women who begin labor with non-pharmacological techniques may choose to transition to anesthetic methods, such as epidural analgesia, as labor intensifies, providing a balance between maintaining control and achieving necessary pain relief^(10, 11). For example, hydrotherapy or TENS might be employed during the early stages of labor, with epidural analgesia introduced as the pain becomes more intense^(8, 13). This approach can help mitigate the potential downsides of a purely anesthetic route—such as reduced mobility and increased interventions—while ensuring that women have access to potent pain relief when needed⁽¹⁴⁾.

The literature also highlights the importance of patient-centered care in pain management. The choice of labor pain relief should reflect the individual preferences, medical conditions, and emotional needs of the laboring woman^(11, 12). Tailoring the approach, whether by starting with non-pharmacological methods or planning for an epidural early, can enhance both the clinical outcomes and the emotional well-being of the mother^(6, 13). This individualized, flexible approach recognizes that labor pain management is not simply about eliminating pain but about fostering a positive and empowering birth experience.

The literature underscores that while anesthetic techniques offer superior pain relief, non-pharmacological approaches contribute to a more satisfying and physiologically harmonious labor experience. Each method has distinct advantages depending on the priorities of the laboring woman—whether those priorities are pain control, autonomy,

or minimizing medical interventions. The future of labor pain management may well lie in a personalized, integrated approach, where women are empowered to make informed decisions and access a combination of methods that best suit their needs throughout labor.

RESULTS

Pain Relief Effectiveness: The studies reviewed present a clear distinction between the effectiveness of anesthetic and non-pharmacological techniques for pain relief during labor. Quantitatively, epidural analgesia consistently emerges as the most effective in reducing pain intensity, with the majority of patients reporting significantly lower pain scores, especially during the later stages of labor^(10, 11). Studies demonstrate that over 90% of women who received epidurals rated their pain relief as excellent or good, particularly in prolonged or more complicated labors^(8, 12). Spinal and combined spinal-epidural techniques also provide rapid and substantial pain relief, though they are primarily reserved for specific circumstances like cesarean sections or very advanced labor^(7, 13).

In contrast, non-pharmacological techniques such as hydrotherapy, breathing exercises, and acupuncture offer moderate pain relief, with varying degrees of effectiveness depending on the individual's labor stage and psychological state^(6, 12). These methods generally result in higher pain scores compared to epidurals, though women often report feeling in control and satisfied with the natural process despite the pain^(9, 14). Qualitative data indicate that while non-pharmacological techniques may not completely eliminate pain, they foster a sense of emotional empowerment and personal involvement in the childbirth experience^(10, 13).

Safety and Side Effects: Anesthetic techniques, particularly epidurals, come with well-documented risks. The most frequently reported side effects include maternal hypotension, fever, urinary retention, and in some cases, motor blockade (5, 10). More serious but rare complications include post-dural puncture headaches and transient neurological symptoms with spinal analgesia (6, 12). For neonates, concerns have been raised about the potential for altered Apgar scores and respiratory depression due to opioid use, although the evidence remains inconclusive and the risks are generally considered low (9, 13). Epidurals have also been linked to a slightly higher incidence of instrumental deliveries and oxytocin augmentation due to the prolongation of labor's second stage (8, 11).

Non-pharmacological techniques are associated with minimal medical side effects. Techniques such as hydrotherapy, TENS, and breathing exercises pose virtually no risk to either the mother or the baby (6, 13). However, certain practices, such as acupuncture, may carry minor risks like skin irritation or discomfort at the needle site, though these are rare and typically mild (9, 12). The main limitation of non-pharmacological methods is their reduced efficacy in controlling pain, which may lead to emotional or physical exhaustion in prolonged labors if additional pain relief methods are not employed (8, 13).

Labor Outcomes: The influence of pain management techniques on labor outcomes is a critical aspect of this comparison. Epidural analgesia is associated with longer second-stage labor, with some studies reporting an increase of up to 30 minutes compared to those not using epidurals (6, 12). Additionally, instrumental deliveries, such as vacuum or forceps assistance, occur more frequently among women receiving epidurals, although cesarean delivery rates remain unaffected (8, 11). Despite the potential prolongation of labor, neonatal health

outcomes remain comparable between epidural and non-pharmacological groups, with no significant differences in Apgar scores or immediate postnatal health (10, 13).

Non-pharmacological techniques, on the other hand, are often associated with shorter second-stage labor and lower rates of instrumental intervention (7, 13). Women who use methods such as movement, water immersion, or breathing techniques tend to have more physiological labor progressions and may avoid the need for augmentation with oxytocin or operative assistance (9, 12). While these techniques may not directly influence neonatal outcomes, their ability to reduce the need for medical interventions can contribute to a smoother postpartum recovery (6, 11).

Maternal Satisfaction: Maternal satisfaction is a complex metric that encompasses more than just pain relief. Studies show that women who receive epidurals typically rate their overall satisfaction with pain relief highly; however, some express disappointment with the reduced mobility and increased medical interventions associated with this method (6, 11, 12). For women who prioritized a natural labor experience, epidural analgesia sometimes resulted in lower overall satisfaction despite effective pain relief (8, 13).

In contrast, women who used non-pharmacological methods often reported higher levels of satisfaction, even if their pain relief was not as profound. The sense of control, autonomy, and active participation in the birthing process is frequently cited as a reason for higher satisfaction scores, particularly among those who desired minimal medical intervention (9, 12). Studies indicate that the psychological and emotional aspects of labor play a significant role in how women perceive their experience, with non-pharmacological techniques aligning more closely with the preferences of those seeking a more natural birth process (7, 14).

DISCUSSION

KEY FINDINGS: EFFECTIVENESS AND SAFETY OF ANESTHETIC VS. NON-PHARMACOLOGICAL TECHNIQUES

The results from the literature underscore a clear distinction between the effectiveness and safety profiles of anesthetic and non-pharmacological techniques in labor pain management. Epidural analgesia, the most commonly used anesthetic method, consistently provides superior pain relief when compared to non-pharmacological methods. The ability to maintain continuous and adjustable pain control throughout labor makes it the most reliable option for women experiencing high levels of pain or complex labor (^{10, 11}). Furthermore, the use of spinal and combined spinal-epidural analgesia offers rapid relief, which is particularly beneficial in specific situations such as cesarean sections or rapidly progressing labor (^{6, 12}).

However, the high efficacy of anesthetic techniques comes with trade-offs. The incidence of side effects, such as maternal hypotension, motor blockade, and potential prolongation of labor's second stage, are more prevalent in the anesthetic group (^{6, 12}). Although studies suggest that epidurals do not significantly raise the risk of cesarean delivery, there is evidence of an increase in instrumental deliveries, likely due to the prolongation of labor and decreased mobility (^{8, 11}). Maternal hypotension and fever, though generally manageable, represent additional complications that must be monitored closely (^{9, 13}).

On the other hand, non-pharmacological methods provide a safer option in terms of avoiding medical complications. Techniques such as hydrotherapy, breathing exercises, acupuncture, and TENS carry minimal risk, making them appealing to women seeking a more natural and intervention-free birthing experience (^{6, 13}). Despite their safety, these

techniques are less effective at controlling intense labor pain, especially during the later stages of labor. Women using non-pharmacological methods often report moderate pain relief, which may not be sufficient for all, leading to potential emotional or physical exhaustion (^{9, 12}). Nonetheless, the absence of significant side effects makes these methods particularly valuable for women with contraindications to anesthetic interventions or those who prefer to avoid medical interventions altogether (^{10, 13}).

The trade-offs between effective pain relief and safety highlight the importance of individualized pain management strategies. For women seeking maximum pain relief and willing to accept the associated risks, anesthetic techniques remain the preferred choice. Conversely, for those prioritizing a natural birthing experience or facing medical contraindications, non-pharmacological methods offer a safer, though less potent, alternative. These findings align with broader research suggesting that patient satisfaction is closely tied not only to pain relief but also to the alignment of labor experiences with personal expectations and birth plans.

CLINICAL IMPLICATIONS: PERSONALIZED PAIN MANAGEMENT PLANS

The findings from this review highlight the need for a more personalized approach to labor pain management in clinical practice. Given the clear differences in efficacy, safety, and maternal satisfaction between anesthetic and non-pharmacological techniques, it is evident that a one-size-fits-all approach is insufficient to meet the diverse needs and preferences of laboring women. Instead, the development and implementation of individualized pain management plans should become a cornerstone of obstetric care, ensuring that women can make informed decisions based on their personal health, pain tolerance, and childbirth goals.

For women with high pain thresholds or those who prioritize minimal medical intervention, non-pharmacological techniques such as breathing exercises, hydrotherapy, and acupuncture offer safe, low-risk options. These methods can be particularly valuable for women with contraindications to anesthetics, such as those with low platelet counts, spinal abnormalities, or allergic reactions to local anesthetics (6, 12). Moreover, for patients aiming for a natural birthing experience, these non-invasive techniques align with their preferences and may enhance emotional well-being during labor, even if they do not provide the same level of pain relief as anesthetic methods (9, 13).

Conversely, for women seeking more comprehensive pain relief or those undergoing longer or more complex labor, anesthetic techniques such as epidural and spinal analgesia are invaluable tools. Their ability to offer continuous and adjustable pain control, especially in prolonged or high-intensity labor, makes them a preferred choice for many (11, 14). Clinicians should be prepared to discuss the potential side effects of these methods, such as motor blockade or the potential for prolonged labor, but also emphasize the low risk of more serious outcomes, such as cesarean delivery (8, 11).

The concept of patient-controlled analgesia (PCEA) is also gaining traction and could represent a middle ground in personalized pain management. Allowing women to self-administer boluses of anesthetic as needed, this method enhances the sense of control over their pain management, leading to increased maternal satisfaction (7, 12). Similarly, newer methods such as programmed intermittent epidural bolus (PIEB) techniques can optimize pain relief while minimizing the total amount of medication used, contributing to better outcomes and fewer side effects (14).

Incorporating shared decision-making into clinical practice is crucial. Healthcare providers must engage in thorough discussions with their patients, outlining both anesthetic and non-pharmacological options, with clear communication about the trade-offs between effective pain relief and potential side effects. A collaborative approach allows for the creation of flexible pain management plans that can be adapted as labor progresses, ensuring that patients feel supported and empowered throughout the process (8, 12).

These findings underscore the importance of an individualized, flexible approach to labor pain management. By tailoring pain relief strategies to meet each woman's medical profile, pain tolerance, and personal preferences, clinicians can not only improve clinical outcomes but also enhance maternal satisfaction, contributing to a more positive labor experience overall.

STUDY LIMITATIONS

While this review provides valuable insights into the comparative effectiveness of anesthetic and non-pharmacological pain management techniques during labor, several limitations across the included studies warrant consideration. One of the primary limitations is the variability in study designs, particularly the differences in sample sizes, patient demographics, and methodologies used to assess pain relief and maternal satisfaction. This heterogeneity makes it challenging to draw definitive conclusions, as the outcomes may not be directly comparable between studies (12, 13). Additionally, many studies relied on self-reported measures of pain and satisfaction, which can be subjective and influenced by factors such as patient expectations and cultural attitudes toward pain (6, 14).

Another significant limitation is the underrepresentation of non-pharmacological techniques in high-quality, large-scale randomized controlled trials (RCTs). While anesthetic techniques, especially epidural analgesia, have been extensively studied in RCTs, non-pharmacological methods often lack the same level of rigorous research. This limits the ability to fully assess their comparative efficacy and safety in diverse populations (11, 12). Furthermore, many studies on non-pharmacological methods fail to account for placebo effects, which can skew results, particularly in interventions like acupuncture or transcutaneous electrical nerve stimulation (TENS) (8, 10).

There is also limited data on long-term maternal and neonatal outcomes associated with both anesthetic and non-pharmacological techniques. While short-term effects such as pain relief, labor duration, and immediate neonatal health are well-documented, there is insufficient research on how these pain management strategies may influence postpartum recovery, maternal mental health, breastfeeding success, and long-term neurodevelopmental outcomes for the child (9, 14).

SUGGESTIONS FOR FUTURE RESEARCH

Given these limitations, future research should prioritize several key areas. First, there is a need for more high-quality RCTs that directly compare anesthetic and non-pharmacological techniques using standardized outcome measures. These studies should aim for larger, more diverse sample populations to ensure that findings are generalizable across different socioeconomic, ethnic, and cultural groups (7, 11). In particular, non-pharmacological techniques such as acupuncture, TENS, and hydrotherapy would benefit from more robust trials to better establish their efficacy and safety compared to well-established anesthetic methods (6, 10).

Long-term studies that follow maternal and neonatal outcomes beyond the immediate postpartum period are also necessary. Such research should explore how different pain management techniques affect maternal mental health, including the risk of postpartum depression, and whether they impact breastfeeding initiation and duration (8, 13). Additionally, there is a need to investigate the potential long-term neurodevelopmental effects of anesthetic techniques, particularly those involving opioids or other medications that may cross the placenta and affect the newborn (11, 12).

Finally, future research should explore emerging non-pharmacological approaches, including mindfulness-based pain relief, hypnotherapy, and other psychological interventions that could be integrated into labor pain management strategies. The growing interest in holistic and minimally invasive pain relief methods suggests that this is a promising area for further exploration (9, 14). These approaches may offer alternative or adjunctive pain management options, particularly for women who wish to avoid pharmacological interventions or have contraindications to anesthetic techniques (12, 14).

In conclusion, while both anesthetic and non-pharmacological techniques have their place in labor pain management, future research is needed to address the current gaps in knowledge and ensure that clinicians can provide evidence-based, personalized care to laboring women.

CONCLUSION

This literature review has highlighted the complexities of labor pain management, emphasizing both the effectiveness and limitations of anesthetic and non-pharmacological techniques. Anesthetic methods, particularly epidural and spinal analgesia, are well-established for providing robust pain relief, en-

suring maternal comfort throughout labor, and enabling flexibility in case of emergency interventions. These techniques have the advantage of precise pain control and adaptability during the different stages of labor, but they are not without risks, such as hypotension, prolonged labor, and increased rates of instrumental deliveries. On the other hand, non-pharmacological techniques such as hydrotherapy, breathing exercises, acupuncture, and TENS offer less invasive alternatives with fewer side effects, though their efficacy in completely managing labor pain is often inconsistent and highly individualized.

One of the main conclusions from this review is that no single method of pain management is universally superior. The choice between anesthetic and non-pharmacological methods should depend on the individual needs, preferences, and medical circumstances of the laboring woman. While anesthetic techniques, especially epidurals, are highly effective, their associated risks and side effects must be carefully weighed, particularly in patients with contraindications or those seeking a more natural birth experience. Non-pharmacological techniques, while less potent in terms of pain relief, offer significant benefits in promoting maternal autonomy, mobility, and emotional satisfaction, making them valuable either as stand-alone methods or as complementary strategies to anesthetic interventions.

A key takeaway from this review is the growing recognition of the need for a personalized and integrated approach to labor pain management. Clinicians should consider offering a combination of anesthetic and non-pharmacological techniques, allowing patients to tailor their pain management plans based on real-time needs and evolving preferences during labor. For example, many women may benefit from starting with non-pharmacological approaches early in labor

to foster relaxation and promote natural progression, while reserving epidural analgesia or other anesthetic techniques for more intense phases of labor or for complications requiring heightened pain control.

Furthermore, the review underscores the importance of patient education and shared decision-making in pain management. Women should be fully informed of the potential risks and benefits associated with each technique, as well as the availability of complementary methods that may enhance their labor experience. Clinicians are encouraged to engage in thorough pre-labor discussions to ensure that pain management strategies are aligned with the patient's goals, medical condition, and cultural context, ultimately leading to greater maternal satisfaction and better labor outcomes.

Finally, the need for ongoing research is clear. The development of newer anesthetic techniques, such as programmed intermittent epidural bolus (PIEB) and patient-controlled epidural analgesia (PCEA), demonstrates the field's evolution towards more individualized and efficient pain management solutions. Simultaneously, greater research into the long-term effects of both anesthetic and non-pharmacological methods, as well as the exploration of emerging pain relief techniques like mindfulness and hypnotherapy, is crucial. By continuing to expand the evidence base, clinicians can make informed decisions that optimize both maternal and neonatal outcomes in labor pain management.

In conclusion, the optimal approach to labor pain management is one that is flexible, evidence-based, and tailored to the individual woman's needs, preferences, and medical circumstances. Combining anesthetic and non-pharmacological techniques offers the best of both worlds—providing effective pain relief while respecting the mother's desire for agency and a positive birth experience.

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