

Bibliometric and Visualization Analysis of Intrapartum Fever Associated with Labor Analgesia Using CiteSpace

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Abstract:

Background: Epidural labor analgesia is widely used, but intrapartum fever has become a major clinical concern. Occurring in 20%–30% of parturients, it may increase neonatal infection risk, lead to unnecessary antibiotic use and cesarean delivery, and threaten maternal–infant safety. Its pathophysiology remains unclear, and current studies are fragmented without systematic trend analysis. **Objective:** To investigate the research status and trends of intrapartum fever associated with labor analgesia, summarize knowledge structure and hotspots, and provide guidance for clinical management and mechanistic studies. **Methods:** Search CNKI for literature published between 2014 and 2024 on labor analgesia and intrapartum fever. Apply bibliometric methods and use CiteSpace to perform visualization analysis: build author collaboration networks, institutional cooperation networks, keyword co-occurrence and clustering maps, as well as timeline and burst term maps, to reveal the evolutionary trajectories and trend dynamics of research themes. **Results:** A total of 147 articles were included. Publications have increased since 2014, with rapid growth after 2020, reflecting rising academic interest. Xu Mingjun and Zeng Huiqian were central authors, but overall collaboration was weak, with limited cross-institutional links. The Department of Anesthesiology, Beijing Obstetrics and Gynecology Hospital, was a key center. Early studies focused on “epidural analgesia” and “analgesic effect,” while recent hotspots shifted to “intrapartum fever,” “complications,” “prognosis,” and “effectiveness.” Emerging directions include inflammatory factors, adverse reactions, and maternal–infant outcomes, indicating a shift from short-term effects to mechanisms and long-term prognosis. **Conclusions:** Research on labor analgesia and intrapartum fever has expanded rapidly, with focus moving from clinical techniques to mechanisms and maternal–infant outcomes. Epidural analgesia provides clear benefits, but epidural-related maternal fever remains a key challenge. Future work should strengthen multicenter collaboration, clarify mechanisms, and evaluate interventions to support evidence-based prevention and standardized practice.

Keywords:

Labor Analgesia, Intrapartum Fever, CiteSpace, Visualization Analysis, Bibliometrics

1. Introduction

With the widespread use of epidural labor analgesia, one of its associated complications—intrapartum fever—has gradually become an important clinical concern in obstetrics. Previous studies have reported that approximately 20%–30% of parturients receiving epidural analgesia develop elevated body temperature ($\geq 38^{\circ}\text{C}$), which not only increases the risk of neonatal infection but may also lead to excessive antibiotic use and unnecessary cesarean deliveries, thereby threatening maternal and neonatal safety [1,2,3]. Although scholars have explored its potential mechanisms from the perspectives of inflammatory response, thermoregulation, and microbiomics [4,5], the underlying pathophysiology remains unclear. Moreover, existing research is fragmented across multiple disciplines, lacking systematic integration of the field's evolution, key contributors, and emerging hotspots. In this context, the present study applied bibliometric methods and used CiteSpace software to perform a visualization analysis of relevant literature retrieved from the CNKI database. Author collaboration networks, keyword co-occurrence clusters, and burst term evolution maps were constructed to reveal the knowledge structure, research hotspots, and developmental trends of this field. The findings are expected to provide evidence-based references for clinical practice, offer directional guidance for mechanistic exploration and preventive strategies, and fill the current gap in bibliometric analyses on this topic.

2. Method

2.1. Data source

The data for this study were obtained from the China National Knowledge Infrastructure (CNKI) database. Advanced search was conducted with the following criteria: subject terms “labor analgesia” and “intrapartum fever”; Chinese-language publications; and a time span from January 1, 2014, to December 31, 2024. The search was performed on February 9, 2025. To ensure the quality of literature selection, two researchers independently screened all retrieved records, and any disagreements were resolved through discussion. Conference papers, research achievements, and articles deemed irrelevant after reviewing the titles and abstracts were excluded. Finally, a total of 147 eligible publications were included in the analysis.

2.2. Research methods

The retrieved literature was saved in Refworks format and imported into CiteSpace (version 5.7.R2) for visualization analysis of authors, institutions, and keywords, as well as for generating keyword clustering timeline and burst detection maps. Parameter settings were as follows: for author and institutional co-occurrence analysis, the time span was set to 2014–2024 with a one-year slice, and the node types were set to “author” and “institution,” while other parameters remained at their default values. For keyword co-occurrence analysis, the slice length was set to two years, the node type was set to “keyword,” the top 100 keywords were selected for each slice, and the

pruning options “pathfinder” and “pruning merged network” were applied, with all other settings kept as default.

3. Result

3.1. Annual publication numbers and trends over the past decade

The number of publications in different periods can reflect the developmental trends of this research field. By searching the CNKI database for studies on labor analgesia and intrapartum fever from 2014 to 2024, a total of 147 articles were retrieved. In terms of annual distribution, only 1 article was published in 2014, 2 in 2015, a rapid increase to 10 in 2016, followed by 5 in 2017, 6 in 2018, and 8 in 2019. Since 2020, the number of publications has shown a marked rise, with 14 in 2020, 26 in 2021, 24 in 2022, 33 in 2023, and 18 in 2024. Overall, research in this field has entered a stage of continuous development since 2014, with the annual output increasing year by year, particularly after 2020, indicating that labor analgesia and intrapartum fever have gradually become key focuses in both clinical and scientific research. The results are shown in Figure 1.

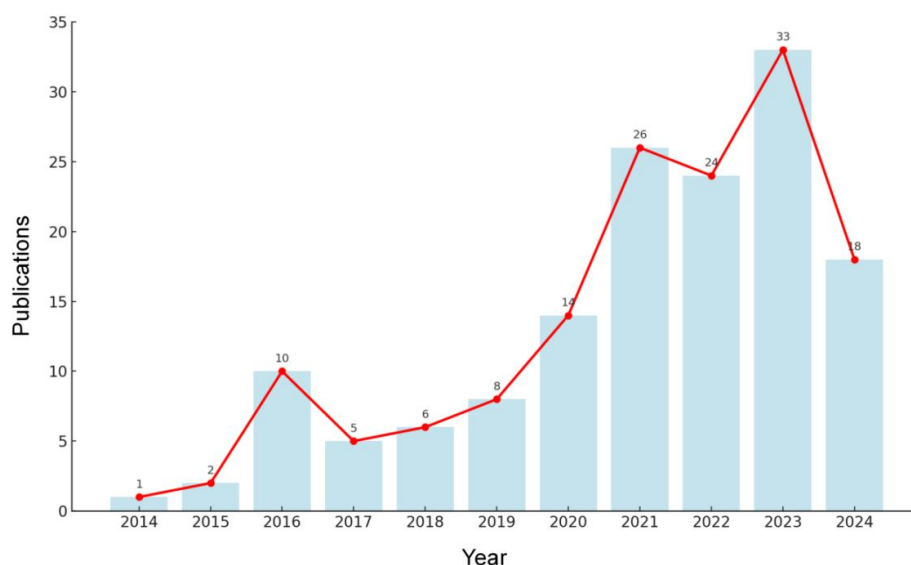


Figure 1. Publication trends of research on labor analgesia and intrapartum fever from 2014 to 2024.

3.2. Author Co-occurrence Analysis

This study conducted a visualization analysis of the author collaboration network from 2014 to 2024, which included 41 author nodes and 94 collaboration links, with a network density of 0.0099. All nodes were located within a single connected cluster, suggesting the presence of overall collaboration but remaining relatively sparse. Xu Mingjun was identified as the core author, highly active in recent years (2021–2024) and maintaining the widest range of collaborations, thereby demonstrating a leading role in this field. Zeng Huiqian served as the secondary core, showing frequent collaborations in recent years and forming a stable group with Xu Zifeng, Lin Yanyan, and Zhang Huizhu. Early active authors, such as Chen Zhihua and Zhang Li, were mainly concentrated between 2014 and 2017, laying the foundation for subsequent studies. During 2018–2020, the network expanded with the participation of Song Kaiying, Bai Yunbo, and Xu Zhangye. From 2021 to 2024, Xu Mingjun and Zeng

Huiqian gradually took the lead, shaping a new collaboration pattern. The results are shown in Figure 2.

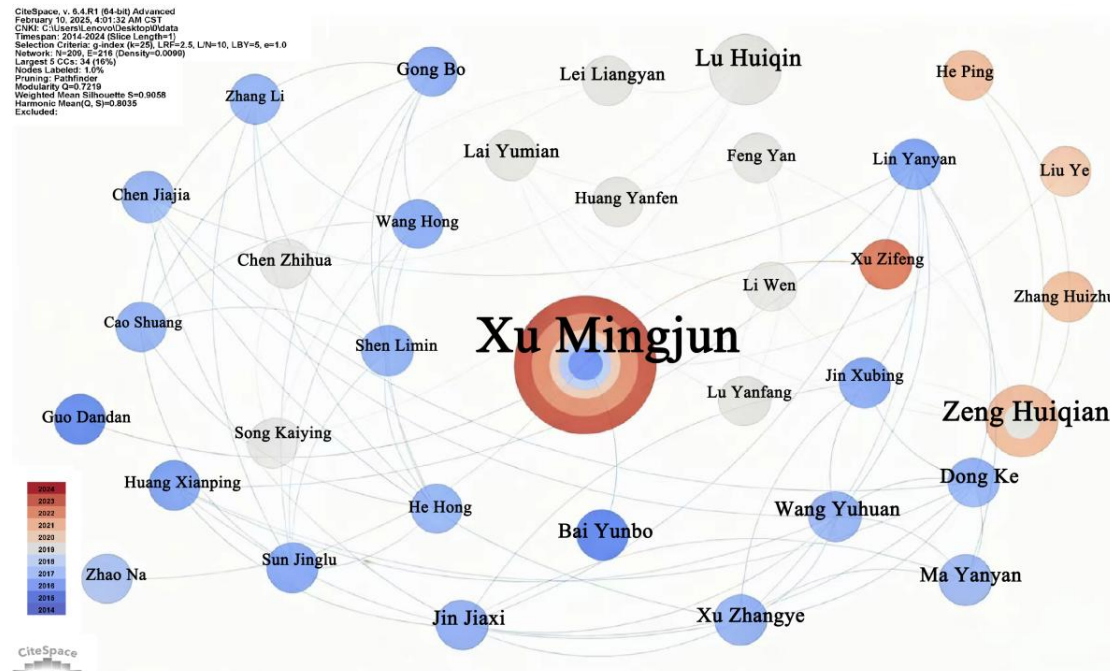


Figure 2. Author co-occurrence network map.

3.3. Institutional Co-occurrence Analysis

This study performed a visualization analysis of institutional collaboration networks from 2014 to 2024, which revealed cooperative relationships among multiple research units. Overall, the Department of Anesthesiology of Beijing Obstetrics and Gynecology Hospital, Capital Medical University, occupied the core position of the network, with the widest range of collaborations.

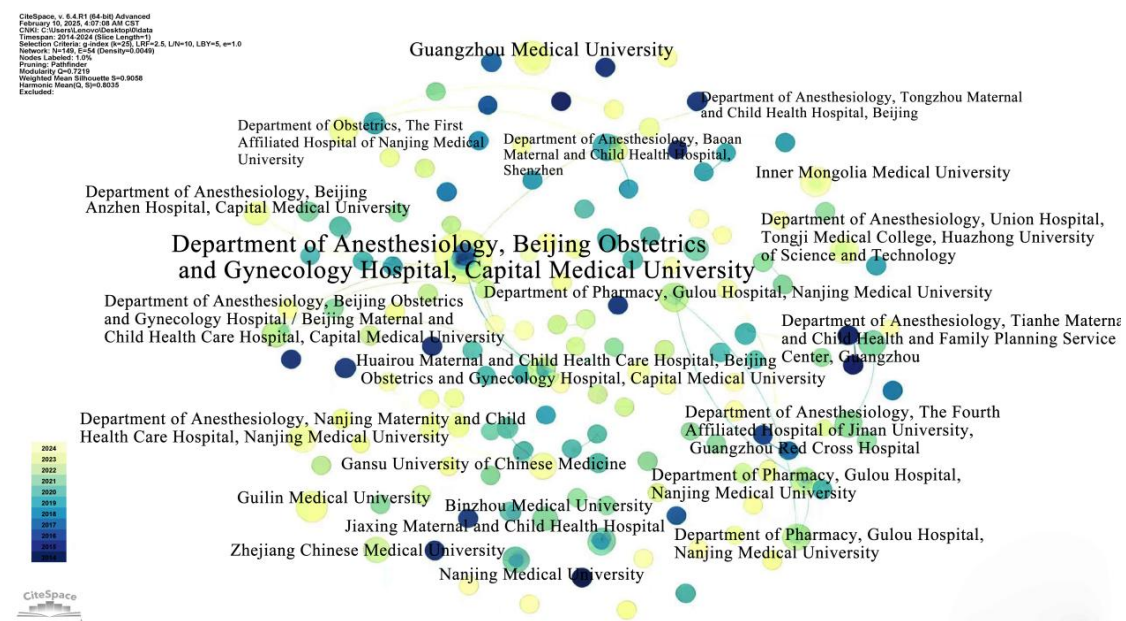


Figure 3. Institutional co-occurrence network map.

It formed a close cooperative cluster with several hospitals within the Capital Medical University system, including Beijing Anzhen Hospital, Beijing Maternal and

Child Health Hospital, and Huairou Maternal and Child Health Hospital. The Nanjing Medical University system (The First Affiliated Hospital, the Affiliated Obstetrics and Gynecology Hospital, and Gulou Hospital) demonstrated strong performance in East China, while Guangzhou Medical University and its affiliated maternal and child health institutions were active in South China. In terms of temporal distribution, early collaborations were mainly initiated by Southern Medical University and Zhejiang Chinese Medical University. Between 2018 and 2020, institutions such as Nanjing Medical University and Guilin Medical University gradually joined the network. From 2021 to 2024, the Department of Anesthesiology of Beijing Obstetrics and Gynecology Hospital, Capital Medical University, emerged as the leading force, driving multi-regional collaborative development across northern and southern China. The results are shown in Figure 3.

3.4. Keyword Co-occurrence Analysis

From 2014 to 2024, research hotspots in this field were mainly concentrated on “labor analgesia” and “intrapartum fever,” with related themes such as “epidural,” “analgesic effect,” “labor process,” and “parturients” forming the research core. In terms of temporal evolution, early studies primarily focused on the evaluation of epidural anesthesia and analgesic efficacy. Between 2018 and 2020, research expanded to labor management, uterine contractions, and cesarean delivery. From 2021 to 2024, increasing attention was paid to complications of labor analgesia (such as intrapartum fever), psychological outcomes (such as depression), and related adjunctive procedures, indicating that research hotspots have gradually shifted toward the comprehensive management of labor analgesia and the optimization of maternal and neonatal outcomes. The results are shown in Figure 4.

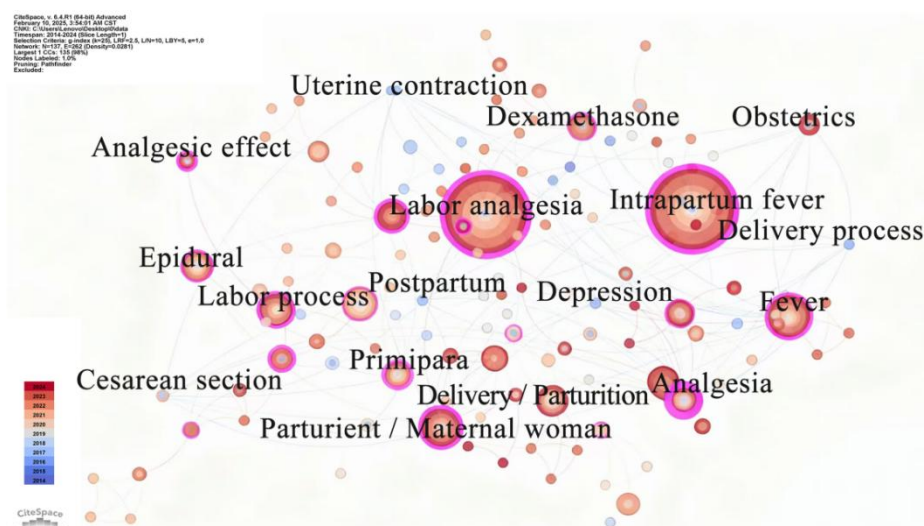


Figure 4. Keyword co-occurrence network map.

3.5. Keyword Clustering Analysis

From 2014 to 2024, research themes were primarily clustered around “intrapartum fever” (#0) and “labor analgesia” (#1), indicating that analgesic efficacy and the management of its complications represent the core hotspots of this field. In addition, clusters such as “primipara” (#2) and “labor duration” (#3) suggest a strong focus on different populations and the impact of analgesia on labor progression. “Complications” (#4) and “mode of delivery” (#6) further extend the scope to

maternal–infant safety and individualized delivery management. In recent years, clusters including “painless delivery” (#8), “prognosis” (#9), and “effectiveness” (#10) have emerged as new research directions, reflecting a shift of hotspots from immediate analgesic effects toward long-term outcomes and the accumulation of evidence-based findings. The results are shown in Figure 5.

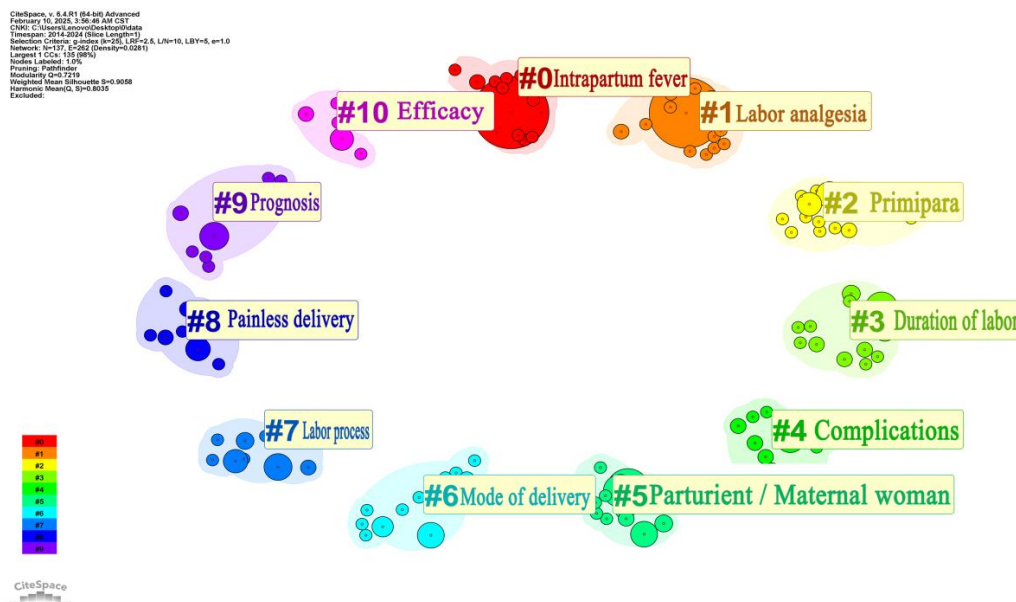


Figure 5. Keyword clustering network map.

3.6. Keyword Clustering Timeline Analysis

From 2014 to 2024, research in this field consistently revolved around the two core themes of “intrapartum fever” and “labor analgesia,” which showed the strongest continuity. After 2016, studies gradually expanded to “primipara,” “labor duration,” and “complications,” reflecting a growing focus on population differences and labor management.

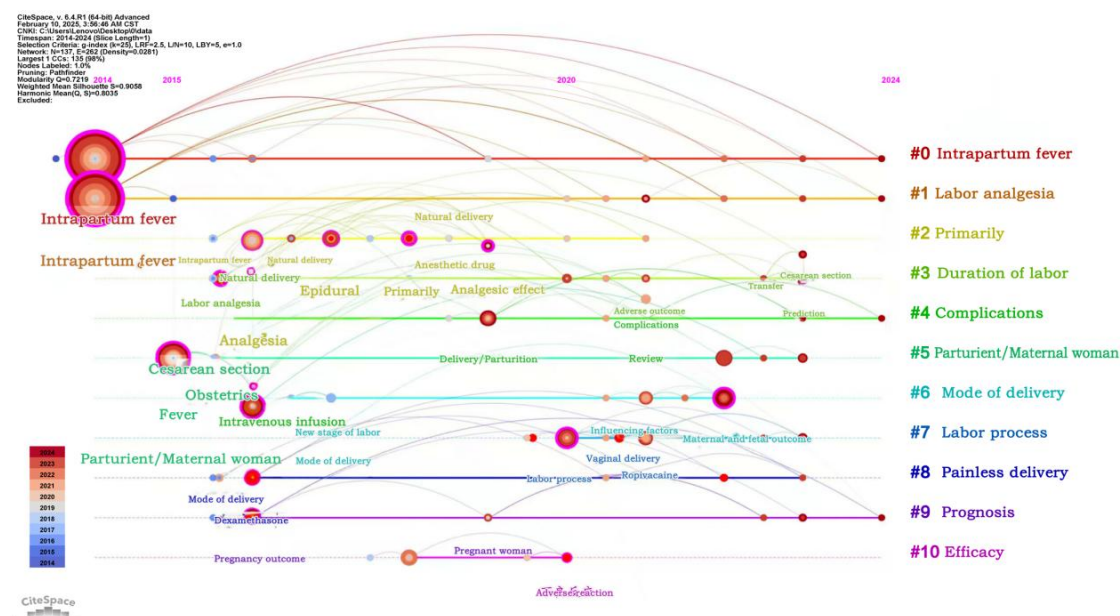


Figure 6. Knowledge map of keyword clustering timeline.

Since 2017, research related to “mode of delivery” and “parturients” has increased, highlighting the trend toward individualized childbirth. Beginning in 2018, “painless delivery” emerged as a hotspot, closely associated with policy promotion. After 2020, growing attention has been directed to “prognosis” and “effectiveness,” suggesting a shift in research focus from immediate analgesic effects to long-term maternal–infant outcomes and evidence-based evaluation, with the research system evolving toward greater multidimensionality and refinement. The results are shown in Figure 6.

3.7. Keyword Burst Analysis

From 2014 to 2017, research hotspots were concentrated on core clinical issues such as “labor analgesia,” “epidural,” and “pregnancy outcome.” Between 2018 and 2021, the focus gradually expanded to “primipara,” “adverse reactions,” and “maternal–infant impact,” indicating increasing attention to specific populations and safety concerns. During 2021–2024, emerging burst keywords such as “vaginal delivery,” “inflammatory factors,” and “analgesic delivery” appeared, suggesting a shift of research toward mechanistic exploration and the promotion of painless delivery. Overall, the evolution of research hotspots has followed the trajectory of “techniques and outcomes → populations and safety → mechanisms and promotion.” The results are shown in Figure 7.

Top 11 Keywords with the Strongest Citation Bursts

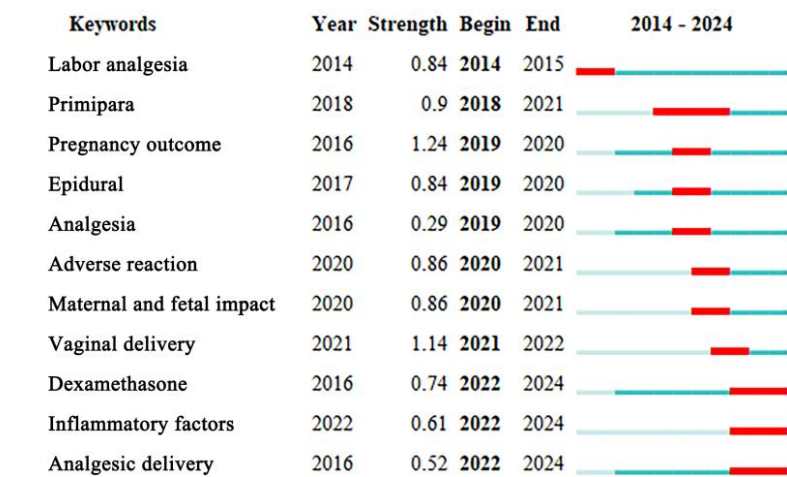


Figure 7. Keyword burst analysis.

4. Conclusions

The bibliometric results of this study showed that research on labor analgesia and intrapartum fever demonstrated a continuous upward trend from 2014 to 2024, with a rapid increase after 2020, suggesting that this topic has gradually become a focus of both academic and clinical attention. Large-scale cohort studies and systematic reviews have provided solid evidence for the safety and benefits of labor analgesia: Kearns et al. [6] reported, based on a cohort of more than 560,000 deliveries, that epidural analgesia significantly reduced the risk of severe maternal morbidity, while meta-analyses confirmed its clear analgesic efficacy without increasing the overall rate of cesarean delivery [7]. These findings indicate that labor analgesia not only improves the childbirth experience but may also offer potential protective effects for maternal safety. However, disparities in the utilization rates of labor analgesia

between domestic and international settings suggest that further efforts are needed in its widespread adoption and standardized clinical management.

Epidural-related maternal fever (ERMF) remains a major concern limiting the widespread use of labor analgesia. Previous studies have reported an incidence of 15%–25% [1,3], and its etiology is not solely attributable to infection; increasing evidence supports an association with inflammatory responses. Khanna et al. [4] demonstrated significantly elevated serum inflammatory cytokine levels in parturients who developed fever, suggesting that immune-inflammatory mechanisms play a key role. Maternal fever has been shown to be associated with neonatal asphyxia, reduced Apgar scores, and an increased risk of neonatal infection [8]. Therefore, balancing the benefits of labor analgesia with the risks of ERMF has become a central issue in both clinical practice and scientific research. Current guidelines, such as those from the American College of Obstetricians and Gynecologists (ACOG) [9], recommend that a single maternal temperature ≥ 39.0 °C, or 38.0–38.9 °C accompanied by high-risk signs, should raise strong suspicion of intra-amniotic infection and warrant timely intervention, providing an actionable clinical standard.

Although various preventive and therapeutic attempts have been made, including modified medication regimens, glucocorticoids, and adjunctive therapies such as acupuncture, recent systematic reviews and network meta-analyses [10,11] have indicated that there is currently no high-quality evidence supporting any single intervention as being able to significantly reduce the risk of ERMF. Future research should therefore focus on three key areas: first, further elucidating the pathophysiological mechanisms of ERMF, particularly the interactions between neuro-immune-inflammatory pathways and the labor process; second, conducting multicenter randomized controlled trials to validate reproducible and generalizable preventive strategies; and third, expanding research perspectives to long-term maternal–infant outcomes and cost-effectiveness evaluations, thereby providing an evidence base for policy-making and clinical promotion. Overall, research on labor analgesia and intrapartum fever is undergoing a transition from evaluating immediate analgesic effects to exploring mechanisms and long-term outcomes. This shift will not only optimize clinical practice but also provide a stronger scientific foundation for improving maternal and neonatal health.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Originality

The article is the original research to authors and has not been published elsewhere, accepted for publication elsewhere, and is not pending acceptance or being considered for publication elsewhere.

Data Availability Statement

The data used in this study were retrieved from the China National Knowledge Infrastructure (CNKI) database. All bibliographic records included are publicly available through CNKI and can be accessed using the described search strategy.

Ethics statement

This study did not involve human participants, animals, or identifiable personal data. All data were obtained from publicly accessible bibliographic databases; therefore, ethical approval and informed consent were not required.

Author Contributions

Ying Bao, Shaoxin Kong, these two authors have contributed equally to this work.

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