DOI: 10.7860/JCDR/2025/76678.20831

Review Article

Anaesthesia Section

Spinal versus Epidural Anaesthesia for Obstetric Delivery: A Narrative Review of Outcome Impacts

NEETA VERMA[1], JANHAVI DAHAKE[2]

ABSTRACT

As the most popular methods of pain management for women in labour, spinal and epidural anaesthesia are commonly used during normal vaginal deliveries. Epidural analgesia offers significant pain relief while maintaining maternal and foetal safety. This method involves the administration of anaesthetic agents into the epidural space, allowing for continuous pain management during labour. Spinal anaesthesia involves injecting a local anaesthetic, often combined with an opioid, into the cerebrospinal fluid in the spinal canal. Both techniques offer distinct advantages and considerations that can significantly impact the labour experience. The present review aims to evaluate all possible findings and outcomes of the comparison between spinal and epidural anaesthesia in normal delivery. Both spinal and epidural anaesthesia significantly impact maternal and foetal outcomes in obstetric care. Spinal anaesthesia provides rapid and profound analgesia, making it ideal for shorter procedures and urgent deliveries. However, its association with motor blockade and the potential prolongation of the second stage of labour requires careful consideration. Epidural anaesthesia, on the other hand, offers greater flexibility in dose adjustment and a more gradual onset, making it suitable for prolonged labour. The choice between spinal and epidural anaesthesia should be guided by factors such as the stage of labour, maternal co-morbidities, anticipated delivery duration and patient preference. Future research should focus on refining anaesthesia protocols to enhance maternal and neonatal outcomes while minimising complications.

Keywords: Analgesia, Labour, Pain, Postoperative complications, Pregnancy

INTRODUCTION

Regional anaesthesia is a cornerstone of modern obstetric care, playing a pivotal role in pain management during labour and caesarean deliveries. Among the various techniques available, neuraxial methods, including spinal and epidural anaesthesia, are the most commonly employed due to their demonstrated efficacy and safety profiles [1]. These approaches not only alleviate pain but also facilitate a more controlled and satisfying birthing experience for many mothers.

Epidural anaesthesia is one of the most widely utilised techniques in obstetrics, especially for labour analgesia. It involves the administration of anaesthetic agents into the epidural space through a catheter, allowing for continuous, adjustable pain management throughout labour. The flexibility of epidural anaesthesia is a key advantage, as it enables clinicians to modify the dosage based on the stage of labour and the patient's needs. This adaptability can lead to a more comfortable and individualised birth experience. Furthermore, epidural anaesthesia preserves maternal alertness and facilitates active participation during delivery. Research indicates that it reduces the incidence of severe labour pain without significantly increasing adverse maternal or neonatal outcomes [2-4].

In contrast, spinal anaesthesia involves a single injection of a local anaesthetic, often combined with an opioid, directly into the cerebrospinal fluid within the subarachnoid space. This technique provides a rapid onset of pain relief by blocking nerve signals from the lower body, making it particularly suitable for shorter procedures or situations requiring immediate analgesia. However, its effects are limited to a shorter duration, typically insufficient for prolonged labour. Despite this limitation, spinal anaesthesia is favoured in scenarios such as emergency caesarean deliveries due to its simplicity and rapid effectiveness [5].

A direct comparison of these techniques highlights their distinct characteristics. Spinal anaesthesia has an average onset time of 4.6 minutes, while epidural anaesthesia has a slower onset of approximately 12.5 minutes. The duration of action for spinal anaesthesia is around 121 minutes, compared to 104 minutes for epidural anaesthesia. However, epidurals provide the advantage of continuous dosing, making them more suitable for lengthy labours. Moreover, epidural anaesthesia allows for dose adjustments to optimise pain relief and maternal satisfaction. This adjustability can reduce complications such as prolonged second-stage labour, which is sometimes associated with neuraxial techniques [6].

Combined Spinal-epidural (CSE) anaesthesia integrates the benefits of both techniques, offering a rapid onset of analgesia alongside the flexibility of continuous epidural administration. CSE is increasingly popular in obstetrics, providing enhanced mobility and a more comfortable experience for the mother. Studies have shown that CSE may reduce the need for additional analgesia during labour, although its impact on overall maternal satisfaction compared to traditional epidurals remains debatable [4,7,8].

One of the key considerations in selecting between spinal and epidural anaesthesia is their side-effect profiles. Spinal anaesthesia is more frequently associated with hypotension due to rapid sympathetic blockade, necessitating vigilant monitoring and prompt management to prevent adverse maternal and foetal outcomes. Conversely, epidural anaesthesia has a more gradual effect on haemodynamics, offering greater stability. However, epidurals may be linked to a higher risk of motor block and delayed ambulation, which can impact postpartum recovery [9].

The choice of anaesthetic technique also has implications for neonatal outcomes. Research has demonstrated that neuraxial anaesthesia methods, including spinal and epidural techniques, generally have minimal adverse effects on neonatal Appearance, Pulse, Grimace, Activity and Respiration (APGAR) scores or acid-base status. However, prolonged labour associated with epidural anaesthesia might increase the likelihood of instrumental deliveries, which could indirectly influence neonatal health. On the other hand, spinal anaesthesia, with its rapid onset, is less likely to prolong

labour but requires careful dose management to avoid excessive motor blockade [10].

Emerging evidence suggests that the nuances of maternal haemodynamics, labour progression and pain management associated with these techniques can significantly influence delivery outcomes. For example, studies have shown that epidural anaesthesia may be associated with longer first and second stages of labour, although this effect does not necessarily translate into adverse neonatal outcomes. Additionally, epidurals have been linked to a slight increase in the incidence of maternal fever, which could necessitate additional interventions. In contrast, spinal anaesthesia, while effective for shorter durations, may not provide adequate coverage for prolonged labour without further interventions, such as repeat dosing or conversion to an epidural technique [11-13].

Another area of interest is the impact of neuraxial anaesthesia on maternal satisfaction and psychological outcomes. Pain relief during labour is critical in shaping a mother's birthing experience. Epidural anaesthesia, with its capacity for continuous and adjustable dosing, often ranks higher in maternal satisfaction surveys compared to spinal anaesthesia. However, the rapid pain relief provided by spinal anaesthesia can also be highly valued, particularly in emergency settings. Combined approaches, such as CSE, offer a middle ground, balancing rapid onset with sustained analgesia and may be particularly advantageous in high-risk obstetric scenarios [5,6].

While the existing research provides valuable insights into the pharmacodynamics, effectiveness and complications of spinal and epidural anaesthesia, there is a need for more comprehensive and up-to-date analyses. Much of the evidence remains fragmented or focused on specific outcomes, such as pain relief or labour duration, without adequately addressing the broader implications for maternal and neonatal health. Additionally, the evolving landscape of obstetric anaesthesia, characterised by increasing maternal co-morbidities and higher-risk pregnancies, underscores the necessity for individualised care plans tailored to each patient's unique circumstances [7].

The present review aimed to bridge these gaps by evaluating the effects of spinal and epidural anaesthesia on various delivery outcomes, including labour duration, maternal haemodynamic status, pain management and neonatal conditions. By synthesising the available evidence, it seeks to provide a comprehensive understanding of how these techniques influence obstetric outcomes, thereby informing clinical decision-making and improving care for both mothers and neonates alike.

REVIEW OF LITERATURE

An electronic search using Google Scholar, PubMed, Scopus and Web of Science was conducted between 1991 and 2024. The search terms used included anaesthesia, labour, spinal anaesthesia, epidural anaesthesia and vaginal delivery. A total of 217 articles, including reviews, research papers and systematic reviews, were initially found. After a thorough evaluation, 25 articles were deemed pertinent to the current study. To investigate the use of spinal anaesthesia and epidural anaesthesia in typical vaginal deliveries, the authors examined these selected articles. The review included only English-language papers for analysis. Articles with ethical issues, conflicts of interest, duplicate publications, non peer-reviewed sources and accessibility issues were systematically filtered out.

DISCUSSION

Mechanism of Action

Spinal or subarachnoid anaesthesia is a regional block in which the intrathecal nerve structures near the spinal cord are anaesthetised. A small amount of local anaesthetic is injected between two lumbar vertebrae into the cerebrospinal fluid space, causing a fast and profound blockade of the body segments caudal to the level of the block, usually below the umbilicus or below the costal arch. The duration of the block depends on the dose and type of local anaesthetic, typically lasting 1-2 hours, rarely more than three hours. Doses depend on the patient's height (which decreases during late pregnancy and with aging): bupivacaine heavy at 7.5-15 mg; pethidine (an opioid with additional local anaesthetic properties) at 50-75 mg diluted with 1-2 mL of Normal Saline (NS). Other local anaesthetics commonly used include lidocaine (50-100 mg), ropivacaine (15-25 mg) and levobupivacaine (10-15 mg), which offer varying durations of action and safety profiles. Adjuvants such as opioids (fentanyl, sufentanil) are often added to spinal anaesthesia to enhance analgesic effects, particularly for procedures requiring extended pain relief. Additionally, alpha-2 agonists such as clonidine and dexmedetomidine are increasingly utilised for their synergistic effects in prolonging block duration and reducing the overall anaesthetic dose. The most common side-effects are bradycardia and hypotension, which are more pronounced if the spread of the block is higher than required. Other potential complications include Post-Dural Puncture Headache (PDPH), Transient Neurologic Symptoms (TNS) and, rarely, nerve damage or infection [9].

Epidural anaesthesia is a technique used to provide pain relief during surgical procedures or childbirth. It involves the injection of local anaesthetics, such as lidocaine, chloroprocaine, or ropivacaine, into the epidural space surrounding the spinal cord. This area is located outside the dura mater, the outermost membrane of the spinal cord. The primary mechanism of action for these local anaesthetics is to block the transmission of nerve signals. When injected, the anaesthetic diffuses through the epidural space and binds to sodium channels on the nerve fibres. This binding prevents sodium ions from entering the nerve cells, which is crucial for generating and propagating nerve impulses. By blocking these nerve signals, the local anaesthetics inhibit the sensation of pain in the areas supplied by the affected nerves.

The onset of the block varies with the type of anaesthetic used. In the study, lidocaine and ultracaine had a quicker onset (approximately 12.1 and 11.1 minutes, respectively) compared to chloroprocaine (15.4 minutes). The duration of the sensory block also varies, with chloroprocaine providing the longest duration (107.1 minutes), followed by ultracaine (94 minutes) and lidocaine (70.6 minutes). Additional agents such as bupivacaine and levobupivacaine are frequently used in epidural anaesthesia for their long-lasting effects and favourable cardiovascular safety profiles. Epidural anaesthesia also accommodates the use of continuous infusion or Patient-controlled Analgesia (PCA), offering tailored pain relief during labour and postoperative recovery [14,15].

Onset and Duration of Analgesia

The onset of analgesia during vaginal delivery can significantly differ between spinal and epidural analgesia techniques. Research indicates that spinal analgesia provides a faster onset of pain relief compared to epidural methods, making it a favourable option for labour analgesia. The study by Imani F et al., compared spinal and epidural anaesthesia in 100 parturients, finding that the mean time to onset of spinal analgesia is approximately 4.6 minutes, with a maximum block achieved in about 8.4 minutes. In contrast, the onset time for epidural analgesia is around 12.5 minutes, with a maximum block reached in 22.2 minutes. Spinal analgesia provides a duration of analgesia lasting about 121 minutes, while epidural analgesia offers a slightly shorter duration of 104 minutes [6].

In the case report by Kuczkowski KM and Bellars R, the onset of spinal anaesthesia occurred rapidly, approximately 3-4 minutes after administering the test dose, resulting in a T2 sensory level. The duration of the spinal block lasted a total of 197 minutes, with delivery occurring 125 minutes later [16]. In a study by Alansary AM et al., the onset of spinal analgesia was significantly faster in the spinal group compared to the epidural group ($p<0.001$). However, the paper does not specify the exact duration of spinal anaesthesia during vaginal delivery [17].

In a study conducted by Lurie S and Matzkel A epidural anaesthesia was administered during the active phase of labour, defined as uterine contractions occurring three minutes apart leading to cervical change. The initial standard dose was 10 mL of 2% lidocaine, followed by a test dose of 2 mL. Subsequent doses included 10 mL of 0.35% bupivacaine without adrenaline or 10 mL of 2% lidocaine. The study found that epidural anaesthesia significantly shortened the first stage of labour (by 4.16 hours in primiparas) and the second stage of labour [18]. The studies showing the onset and duration of analgesia is summarised in [Table/Fig-1] [6,16-18].

Authors	Sample size	Onset of analgesia	Duration of analgesia
Imani F et al., [6]	100	Spinal: 4.6 minutes Epidural: 12.5 minutes	Spinal: 121 minutes Epidural: 104 minutes
Kuczkowski KM and Bellars R [16]	1	Spinal: 3-4 minutes	Spinal: 197 minutes
Alansary AM et al., [17]	100	The onset of spinal analgesia was significantly faster in the spinal group compared to the epidural group (the study did not mention exact values)	
Lurie S and Matzkel A [18]	1206	Epidural anaesthesia shortened the first stage by 4.16 hours in primiparas and the second stage of labour.	

[Table/Fig-1]: Onset and duration of analgesia [6,16-18].

Time Required to Perform the Block

Alansary AM et al., found in their study that spinal anaesthesia is significantly faster to perform, taking approximately 5.2 minutes compared to 17.3 minutes for epidural anaesthesia. Spinal anaesthesia is particularly suitable for parturients in the late first stage of labour due to its quick administration and onset, providing effective pain relief when time is limited. While spinal anaesthesia offers significant time advantages, it is essential to consider the broader context of labour and delivery. Factors such as the duration of analgesia, potential side-effects and the specific needs of the parturient should be evaluated. Additionally, while spinal anaesthesia is efficient, the overall process of labour management involves multiple steps and team coordination, which can impact the total time from decision to delivery [17].

It is important to note that while spinal anaesthesia provides time advantages, consideration of the broader context of labour and delivery remains crucial. Factors including the duration of analgesia, potential side-effects and the specific needs of the parturient must be assessed. Furthermore, although spinal anaesthesia is efficient, the overall labour management process entails multiple steps and team coordination, which can affect the total time from decision to delivery [19,20].

Maximum Sensory Level Achieved

The maximum sensory level achieved during spinal anaesthesia compared to epidural anaesthesia in vaginal delivery shows significant differences in efficacy and onset time. Spinal anaesthesia typically provides a higher and faster onset of sensory block compared to epidural techniques, making it a preferred choice for labour analgesia. In a study by Sheela S et al., it was found that the maximum sensory block in spinal anaesthesia can reach levels as high as T2. Epidural anaesthesia, while effective, generally results in a lower maximum sensory block, often reaching T4-5 levels [21]. Hussain T et al., conducted a study involving elective caesarean sections, where the maximum sensory block achieved was T3, with a range from T2 to T7. This was accomplished using 1.8 mL of 0.75% hyperbaric bupivacaine and the mean time to achieve this block was approximately 9.2 minutes [22]. The studies showing the maximum sensory level achieved is summarised in [Table/Fig-2] [21,22].

APGAR Scores

The relationship between epidural anaesthesia during vaginal delivery and the APGAR scores of newborns has been the subject of investigation, yielding mixed results. Some studies indicate a significant association between intrapartum epidural analgesia and lower APGAR scores, while others find no such correlation.

Authors	Sample size	Maximum sensory level
Sheela S et al., [21]	100	Spinal anaesthesia: T2 Epidural anaesthesia: T4-T5
Hussain T et al., [22]	100	Spinal anaesthesia: T3

[Table/Fig-2]: Maximum sensory level achieved [21,22].

A study by Ravelli ACJ et al., employed several rigorous methods to assess the impact of intrapartum epidural analgesia on low APGAR scores and Neonatal Intensive Care Unit (NICU) admissions among singleton infants born at term. The study analysed a national cohort consisting of 715,449 term live-born singletons in the Netherlands. They concluded that a large propensity score-matched study found that epidural analgesia was associated with a 1.9 times higher risk of a 5-minute APGAR score <7 and a 1.8 times higher risk of a score <4, particularly in spontaneous deliveries [23].

Alexander S et al., conducted an observational study that looked back at data collected from past labours to analyse outcomes related to epidural analgesia and newborn APGAR scores. The study analysed the labour processes of 1,850 out of 2,006 parturients. Of these, 3.8% of newborns had APGAR scores below 7, but no significant predictors were identified, including the timing and modality of epidural analgesia [24].

Cutura N et al., conducted a study to establish the influence of epidural anaesthesia on the first and second parts of the delivery process, the frequency of vacuum extractor and forceps use and the effect of epidural anaesthesia on the newborn. The APGAR scores of newborns from deliveries with epidural anaesthesia were slightly higher than those without; however, the differences were not statistically significant. The study indicated no adverse effects of epidural anaesthesia on the newborn's condition at birth [25].

The study by Bakhsha F et al., employed a systematic approach to evaluate the APGAR scores of newborns delivered through vaginal delivery and spinal anaesthesia. A total of 215 cases were selected for the study. A 92.5% of newborns scored above seven at one minute and 94% at five minutes, regardless of the delivery method. The APGAR scores of the newborns were checked at two critical time points: one minute and five minutes after birth. Factors such as prematurity, low birth weight and maternal preeclampsia were shown to significantly affect APGAR scores, rather than the use of spinal anaesthesia [26]. The studies related to APGAR scores is summarised in [Table/Fig-3] [23-26].

Authors	Sample size	APGAR score
Ravelli ACJ et al., [23]	1,28936	Epidural analgesia: 1.9 times higher risk of a 5-minute APGAR score <7 and a 1.8 times higher risk of <4, particularly in spontaneous deliveries
Alexander S et al., [24]	1,850	Epidural analgesia: 3.8% of newborns had APGAR scores below 7, but no significant predictors were identified.
Cutura N et al., [25]	1490	APGAR scores of newborns from deliveries with epidural anaesthesia were slightly higher than those without.
Bakhsha F et al., [26]	215	Spinal anaesthesia: 92.5% of newborns scored above seven at one minute and 94% at five minutes, regardless of the delivery method.

[Table/Fig-3]: APGAR score [23-26].

Pain Management and Labour Progression

Spinal anaesthesia has shown significant efficacy in managing labour pain. Larijani SS et al., evaluated maternal outcomes in 120 women undergoing vaginal delivery with and without spinal anaesthesia. The study revealed that spinal anaesthesia effectively reduced pain but prolonged the second stage of labour, with no significant difference in the duration of the active phase [27].

Similarly, Imani F et al., compared spinal and epidural anaesthesia in 100 parturients, finding that spinal anaesthesia provided quicker analgesia onset with fewer reinfusions than epidural anaesthesia, which required repeated doses to maintain pain relief [6].

Olszynska A et al., conducted a study that employed a cohort design to investigate the effects of epidural analgesia on labour duration and delivery mode. The participants were divided into two groups: those who received epidural analgesia and a control group that did not receive any anaesthesia. Patients who received epidural analgesia experienced significantly longer labour durations compared to those in the control group. Both the first and second stages of labour were longer for patients who received epidural analgesia, but the risk of emergency caesarean sections was lower in the group that received epidural analgesia [12].

Madhu KN and Dileep Kumar HR conducted a study that included a total of 120 parturient women to evaluate foetal-maternal outcomes in subjects undergoing epidural labour analgesia with ripivacaine and fentanyl. Participants were grouped into two categories based on their treatment: those receiving epidural analgesia and a control group not receiving it. The first stage of labour was significantly shorter in the epidural group compared to the control group. Specifically, in the 5-6 cm cervical dilation group, the duration was 1.8 hours shorter than in the control group. The total duration of labour was also shorter in the epidural group. In the 4 cm group, the duration was 1.1 hours less than in the control group, while in the 5-6 cm group, the epidural group had fewer instrumental deliveries and caesarean sections compared to the control group [28].

Kamali A conducted a double-blind clinical trial in which a total of 90 pregnant women were recruited for the study. These participants were randomly divided into three groups: one receiving spinal analgesia, another receiving epidural analgesia and a control group that did not receive any analgesia. When comparing the epidural and spinal analgesia groups, the study found no significant difference in the mean duration of the second stage of labour. The study concluded that while the control group experienced a shorter duration of the second stage of labour, both epidural and spinal analgesia provided similar outcomes in terms of labour duration, suggesting that either method could be effectively used for pain management during vaginal delivery [29].

AbdElBarr T et al., investigated the analgesic efficacy of single-dose spinal anaesthesia versus epidural anaesthesia, reporting longer-lasting analgesia and higher satisfaction rates with spinal anaesthesia. However, hypotension was less frequent in the spinal anaesthesia group (8%) compared to the epidural anaesthesia group (14%) [30].

Rahmati J et al., conducted a study that compared the effectiveness of single-dose spinal analgesia to epidural analgesia for managing labour pain. The study found that spinal analgesia provided significantly lower pain intensity scores at 30 minutes and 90 minutes after administration compared to the epidural group. Additionally, the mean duration of analgesia was longer in the spinal group than in the epidural group [31]. The studies discussing pain management and labour progression are summarised in [Table/Fig-4] [6,12,27-31].

Authors	Sample size	Pain management and labour progression
Larijani SS et al., [27]	120	Spinal anaesthesia effectively reduced pain but prolonged the second stage of labour.
Imani F et al., [6]	100	Spinal anaesthesia provided quicker analgesia onset with fewer reinfusions than epidural anaesthesia.
Olszynska A et al., [12]	1052	The first and second stages of labour were longer for patients who received EA when compared to patients who did not receive anything
Madhu KN and Dileep Kumar HR [28]	100	The total labour and 1st stage duration was shorter in the epidural groups. In Epidural groups, there were fewer instrumental deliveries and caesarean sections compared to the control group, which received nothing.
Kamali A [29]	90	Epidural and spinal analgesia provided similar outcomes in terms of labour duration, suggesting that either method could be effectively used for pain management during vaginal delivery.
AbdElBarr T et al., [30]	100	Longer-lasting analgesia and higher satisfaction rates with spinal anaesthesia when compared to epidural
Rahmati J et al., [31]	128	Spinal analgesia provided significantly lower pain intensity scores at 30 minutes and 90 minutes after administration compared to the epidural group

[Table/Fig-4]: Pain management and labour progression [6,12,27-31].

Haemodynamic Stability

Spinal anaesthesia during labour can significantly impact haemodynamic stability, particularly in obstetric patients. Research indicates that while spinal anaesthesia is effective for pain management, it can lead to hypotension and bradycardia, necessitating careful monitoring and management strategies. Epidural anaesthesia is associated with greater haemodynamic stability but requires meticulous monitoring due to a higher incidence of hypotension. Ghidini A et al., documented severe maternal hypotension in 36.2% of cases receiving epidural anaesthesia; spinal anaesthesia often results in profound hypotension due to sympathetic blockade, which vasopressors like phenylephrine and noradrenaline can mitigate. Studies show that noradrenaline may provide better haemodynamic stability than phenylephrine during caesarean sections, emphasising the need for close monitoring [32,33].

The study by Rahmati J et al., indicated no significant differences in the rates of caesarean sections, duration of labour, postpartum haemorrhage, or foetal heart deceleration between the spinal and epidural groups [31]. The studies discussing haemodynamic stability is summarised in [Table/Fig-5] [31,32].

Authors	Sample size	Haemodynamic stability
Ghidini A et al., [32]	439	Severe maternal hypotension in 36.2% of cases receiving epidural anaesthesia; spinal anaesthesia often results in profound hypotension due to sympathetic blockade, which vasopressors like phenylephrine and noradrenaline can mitigate.
Rahmati J et al., [31]	128	There were no significant differences in the rates of caesarean sections, duration of labour, postpartum haemorrhage, or foetal heart deceleration between the spinal and epidural groups.

[Table/Fig-5]: Haemodynamic stability [31,32].

Neonatal Condition

The impact of spinal and epidural anaesthesia on neonatal outcomes, such as APGAR scores and umbilical artery blood gas parameters, has been extensively studied. Patel NP et al., found no significant differences in APGAR scores or acid-base status between infants born to mothers receiving epidural or CSE analgesia [34]. Similarly, Ahmadi S et al., investigated the effects of spinal analgesia and Entonox analgesia on various foetal outcomes during labour, concluding that spinal analgesia is a safe method for pain relief during labour, with no adverse effects on neonatal health compared to Entonox analgesia. Their study supports the notion that both analgesia techniques can be used effectively without compromising foetal wellbeing, as evidenced by similar APGAR scores, newborn weights and arterial blood gas measurements across both groups [10].

Butwick AJ et al., conducted a study that analysed data from 106,845 women who underwent operative vaginal delivery. They focused on women with non anomalous singleton pregnancies who had either vacuum-assisted or forceps-assisted deliveries. They found that the rate of neonatal morbidity was higher among the group that received neuraxial analgesia compared to those who did not. Specifically, 11.3% of neonates in the neuraxial group experienced morbidity, while only 8.9% in the non neuraxial group did. The most common types of neonatal morbidity observed included the need for neonatal intensive care

admission, immediate assisted ventilation and low APGAR scores at five minutes [35].

While neither technique adversely affects long-term neonatal outcomes, epidural anaesthesia is associated with a higher incidence of abnormal Foetal Heart Rate (FHR) patterns. Shuai F et al., observed that epidural anaesthesia significantly increased the duration of labour but had no detrimental effects on immediate neonatal health outcomes, as evidenced by comparable 1-minute APGAR scores [36]. Patel NP et al., similarly noted an increase in abnormal FHR patterns following epidural analgesia, although these did not translate into adverse neonatal outcomes [34]. The studies discussing neonatal conditions are summarised in [Table/Fig-6] [10,34-36].

Authors	Sample size	Neonatal condition
Patel NP et al., [34]	115	Found no differences in neonatal outcomes in patients receiving epidural or Combined Spinal-epidural (CSE) analgesia
Ahmadi S et al., [10]	280	There are no differences in neonatal outcomes for spinal and epidural anaesthesia. Similar APGAR scores, newborn weights and arterial blood gas measurements across both groups
Butwick AJ et al., [35]	106,845	11.3% of neonates in the neuraxial group experienced morbidity, while only 8.9% in the non neuraxial group did. It included the need for neonatal intensive care admission, immediate assisted ventilation and low APGAR scores at 5 minutes
Shuai F et al., [36]	159	Neither technique adversely affects long-term neonatal outcomes and epidural anaesthesia is associated with a higher incidence of abnormal foetal heart rate patterns.

[Table/Fig-6]: Neonatal condition [10,34-36].

Adverse Effects

Both spinal and epidural anaesthesia are associated with specific adverse effects. Post-dural Puncture Headache (PDPH), hypotension and pruritus are more commonly associated with spinal anaesthesia, whereas epidural anaesthesia carries risks such as catheter-related complications and higher rates of prolonged labour. Ghidini A et al., highlighted a 41.9% incidence of adverse reactions with epidural analgesia, including severe hypotension and foetal heart rate abnormalities [32]. Rare complications such as nerve injuries, respiratory depression and local anaesthetic toxicity have been documented with both techniques. Proper aseptic techniques and vigilant monitoring are essential to minimise these risks [37].

Epidural anaesthesia has been linked to delayed initiation and reduced success rates of breastfeeding, potentially due to its interference with oxytocin release. Tamagawa K and Weaver J noted increased maternal and neonatal morbidity associated with epidural analgesia, underscoring the importance of informed decision-making [38].

Parnass SM and Schmidt KJ found that spinal anaesthesia during vaginal delivery can lead to several adverse effects, primarily impacting maternal haemodynamics and overall delivery outcomes. A common issue is that spinal anaesthesia can cause significant maternal hypotension due to sympathetic blockade, leading to decreased cardiac output. Hypotension is a frequent side-effect, occurring in up to 75% of cases due to sympatholysis, which can compromise uterine blood flow and lead to foetal hypoxia and acidosis. Preventive measures such as fluid preloading and the use of vasopressors like phenylephrine are recommended to mitigate this risk.

While spinal anaesthesia is associated with certain risks, it remains a widely used technique due to its effectiveness in pain management during labour. However, vigilance and proper monitoring are essential to mitigate these potential adverse effects [39]. The studies showing adverse effects are summarised in [Table/Fig-7] [32,38,39].

Authors	Sample size	Adverse effects
Ghidini A et al., [32]	439	41.9% incidence of adverse reactions with epidural analgesia, including severe hypotension and foetal heart rate abnormalities
Tamagawa K and Weaver J [38]	According to the review, increased maternal and neonatal morbidity associated with epidural analgesia and delayed initiation and reduced success rates of breastfeeding, potentially due to its interference with oxytocin release	
Parnass SM and Schmidt KJ [39]	According to the review, spinal anaesthesia can cause significant maternal hypotension due to sympathetic blockade, leading to decreased cardiac output. Hypotension is a common side-effect, occurring in up to 75% of cases	

[Table/Fig-7]: Adverse effects [32,38,39].

CONCLUSION(S)

Spinal and epidural anaesthesia are both effective for pain relief during vaginal delivery, each with distinct advantages. Spinal anaesthesia provides rapid, profound analgesia, making it ideal for emergencies; however, it carries a higher risk of hypotension and PDPH. Epidural anaesthesia offers better haemodynamic stability and allows for continuous dosing during prolonged labour, but it may increase the likelihood of instrumental deliveries. While neonatal outcomes show no significant differences between the two methods, epidural anaesthesia has been linked to abnormal foetal heart rate patterns. The choice between techniques should be individualised, considering the stage of labour, maternal factors and patient preference to optimise safety and effectiveness.

REFERENCES

[1] da Costa Gribel GP. Analgesia and anesthesia at birth. In: Moreira de Sá RA, Fonseca EB da, editors. Perinatology: Evidence-Based Best Practices in Perinatal Medicine [Internet]. Cham: Springer International Publishing; 2022 [cited 2024 Nov 5]. Pp. 891-911. Available from: https://doi.org/10.1007/978-3-030-83434-0_49.

[2] Lakshmi SSN, Sheela SR, Kiran N. Epidural analgesia in labour and its obstetric outcome. Int J Reprod Contracept Obstet Gynecol [Internet]. 2023 Aug 29 [cited 2024 Nov 5];12(9):2658-64. Available from: https://www.ijrcog.org/index.php/ijrcog/article/view/13233.

[3] Rahardjo TM, Suryawan A, Yusran UJN, Suryawan AZ. Effectivity of walking epidural analgesia in normal labor to reduce labor pain and improve neonatal outcome. JAI J Anestesiol Indones [Internet]. 2024;16(2):173-79. Available from: https://ejournal.undip.ac.id/index.php/janesti/article/view/63230.

[4] Kamal MM, Debnath K, Afroz S, Moinuddin M, Haque MS, Uddin MA, et al. Labour epidural analgesia on maternal and neonatal outcome: A retrospective observational study. Bangladesh J Pain [Internet]. 2021;1(2):29-33. Available from: https://bjpain.org/index.php/bjpain/article/view/68.

[5] Musa C, Hildebrand A. How does regional anesthesia (epidural or combined spinal-epidural) affect childbirth outcomes? Evid-Based Pract [Internet]. 2016 Oct [cited 2024 Nov 5];19(10):10. Available from: https://journals.lww.com/ebp/abstract/2016/10000/how_does_regional_anesthesia__epidural_or_combined.11.aspx.

[6] Imani F, Lotfi S, Aminisaman J, Shahmohamadi A, Ahmadi A. Comparison of spinal versus epidural analgesia for vaginal delivery: A randomized double blinded clinical trial. Anesthesiol Pain Med. 2021;11(1):e108335.

[7] Simmons SW, Taghizadeh N, Dennis AT, Hughes D, Cyna AM. Combined spinal-epidural versus epidural analgesia in labour - Simmons, SW - 2012 | Cochrane Library. [cited 2024 Nov 5]; Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD003401.pub3/full.

[8] Orange FA, Passini R Jr, Melo AS, Katz L, Coutinho IC, Amorim MM. Combined spinal-epidural anesthesia and non-pharmacological methods of pain relief during normal childbirth and maternal satisfaction: A randomized clinical trial. Rev Assoc Med Bras (1992). 2012;58(1):112-17. ScienceDirect [Internet]. [cited 2025 Jan 27]. Available from: https://www.sciencedirect.com/science/article/pii/S0104423012704773?via%3Dihub.

[9] Vallejo MC, Firestone LL, Mandell GL, Jaime F, Makishima S, Ramanathan S. Effect of epidural analgesia with ambulation on labor duration. Anesthesiology. 2001;95(4):857-61. Available from: https://pubs.asahq.org/anesthesiology/article/95/4/857/39111/Effect-of-Epidural-Analgesia-with-Ambulation-on.

[10] Ahmadi S, Farahani K, Aklamli M, Ahmadi K, Beheshti N. Spinal analgesia in labor on maternal and neonatal outcomes: A retrospective cross sectional study. J Obstet Gynecol Cancer Res [Internet]. 2022 Jan 12 [cited 2024 Nov 5];7(3):186-91. Available from: https://www.jogcr.com/article_697290.html.

[11] Stewart A, Fernando R. Maternal ambulation during labor. Curr Opin Anaesthesiol. 2011;24(3):268-73.

[12] Olszynska A, Di Martino Z, Pawlowska A, Feduniw S, Modzelewski J, Kajdy A, et al. Epidural analgesia: Effect on labor duration and delivery mode- a single-center cohort study. Ginekol Pol. 2023;94(9):733-40. Available from: https://journals.viamedica.pl/ginekologia_polska/article/view/93771.

[13] Syed AB, Kapote DS. A study to determine the effects of epidural analgesia in labour and to assess its maternal and neonatal outcome. Int J Reprod Contracept Obstet Gynecol [Internet]. 2023 Nov 28 [cited 2025 Feb 1];12(12):3491-97. Available from: https://www.ijrcog.org/index.php/ijrcog/article/view/12292.
[14] Kietzmann D. Spinal Anaesthesia. In: Kietzmann D, editor. Anaesthesia in Remote Hospitals: A Guide for Anaesthesia Providers [Internet]. Cham: Springer International Publishing; 2023 [cited 2024 Nov 5]. p. 115-22. Available from: https://doi.org/10.1007/978-3-031-46610-6_10.
[15] Svetlov VA, Kozlov SP. Pharmacology of local anesthetics and clinical aspects of segment blockade. I. Epidural anesthesia. Anesteziol Reanimatol. 1997;(5):52-55.
[16] Kuczkowski KM, Bellars R. Prolonged spinal anesthesia in a parturient after administration of a standard epidural test dose with lidocaine and epinephrine. Acta Anaesthesiologica Scandinavica. 2203;47(8):1050. [cited 2025 Jan 21]. Available from: https://onlinelibrary.wiley.com/doi/10.1034/j.1399-6576.2003.00195.x.
[17] Alansary AM, Ali MM, Elbeialy MAK. Epidural versus low-dose spinal for analgesia of late first stage of labor: A randomized clinical trial. Anaesth Pain Intensive Care [Internet]. 2023 Apr 5 [cited 2025 Jan 21];27(2):227-35. Available from: https://www.apicareonline.com/index.php/APIC/article/view/2193.
[18] Lurie S, Matzkel A. Epidural anesthesia shortens duration of labor in singleton vertex presentation spontaneous delivery. Asia-Oceania Journal of Obstetrics and Gynaecology. 1991;17(3):203-05. [Internet]. [cited 2025 Jan 21]. Available from: https://obgyn.onlinelibrary.wiley.com/doi/10.1111/j.1447-0756.1991.tb00261.x.
[19] Wood MS, Oakes ND, Roberts M, Grassmann C. Accidental underdosing of intrathecal diamorphine. Anaesthesia [Internet]. 2013 [cited 2025 Jan 23];68(9):977-78. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/anae.12404.
[20] Buettner AU. Speed of onset of spinal vs general anaesthesia for caesarean section. Anaesthesia. 2013;68(11):1203. Wiley Online Library [Internet]. [cited 2025 Jan 23]. Available from: https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/10.1111/anae.12468.
[21] Sheela S, Sehar NE, Nirmala BC, Santosh R. Effect of epidural volume on spinalanaesthesia in patients undergoing gynaecological surgery. International Journal of Scientific Research. ResearchGate [Internet]. 2024 Oct 22 [cited 2025 Feb 15]; Available from: https://www.researchgate.net/publication/354096635_effect_of_epidural_volume_on_spinalanaesthesia_in_patients_undergoing_gynaecological_surgery.
[22] Hussain T, Zahir J, Rehman H, Iqbal M, Adalat S. Maximal sensory block and haemodynamics after spinal anaesthesia in women undergoing elective caesarean section. In 2015 [cited 2025 Feb 15]. Available from: https://www.semanticscholar.org/paper/maximal-sensory-block-and-haemodynamics-after-in-hussain-Zahir/c52dd89f911767b44d62133cc47429da8eced2b7.
[23] Ravelli ACJ, Eskes M, Groot CJM de, Abu-Hanna A, Post JAM van der. Intrapartum epidural analgesia and low Apgar score among singleton infants born at term: A propensity score matched study. Acta Obstet Gynecol Scand [Internet]. 2020;99(9):1155. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7497260/.
[24] Saraiva A, Duarte S, Lagarto F, Figueira H, Nunes CS, Lemos P, et al. Is epidural analgesia a predictor of low newborn apgar? A hospital-based observational study. J Anesth Clin Res. 2015;06(09):01-06. [cited 2025 Jan 24]. Available from: https://www.researchgate.net/publication/283683871.
[25] Cutura N, Soldo V, Curković A, Tomović B, Mitrović T. Effects of epidural anesthesia on I and II delivery stage and on a newborn. Vojnosanit Pregl. 2009;66(4):319-22.
[26] Bakhsha F, Yousefi Z, Aryaie M, Jafari SY, Rad AT, Abbasi A. Comparison of Apgar score in new born by vaginal delivery and spinal anesthesia and its relationship with contributing factors. Journal of Basic Research in Medical Sciences. 2016;1(3):10-15. [Internet]. [cited 2025 Jan 24]. Available from: https://www.researchgate.net/publication/367002008.
[27] Larijani SS, Niksolat M, Mirfakhraee H, Rahimi M, Asadi S, Mahdavynia S, et al. Comparison of the outcomes of normal vaginal delivery with and without spinal anesthesia in mothers admitted to the maternity ward of Firoozabadi Hospital. J Fam Med Prim Care [Internet]. 2022;11(9):5633. Available from: https://journals.lww.com/jfmpc/fulltext/2022/09000/comparison_of_the_outcomes_of_normal_vaginal.107.aspx.
[28] Madhu KN, Dileep Kumar HR. Feto-maternal outcome in subject undergoing epidural labour analgesia with Ripovacaine and Fentanyl. Int J Reprod Contracept Obstet Gynecol [Internet]. 2018 Jan 23 [cited 2025 Jan 5];7(2):659-64. Available from: https://www.ijrcog.org/index.php/ijrcog/article/view/4140.
[29] Kamali A. Comparison stage of vaginal delivery in painless labor with epidural & spinal analgesia [Internet]. Journal of Clinical and Analytical Medicine. 2018;9(1):82-86. [cited 2025 Jan 5]. Available from: http://archive.org/details/comparison-stage-of-vaginal-delivery-in-painless-labor-with-epidural-spinal-analgesia.
[30] AbdElBarr T, Elshalakany NA, Shafik YM. Single dose spinal analgesia: Is it a good alternative to epidural analgesia in controlling labour pain? Egypt J Anaesth [Internet]. 2014 Jul 1 [cited 2024 Nov 7];30(3):241-46. Available from: https://www.sciencedirect.com/science/article/pii/S1110184914000154.
[31] Rahmati J, Shahriari M, Shahriari A, Nataj M, Shabani Z, Moodi V. Effectiveness of spinal analgesia for labor pain compared with epidural analgesia. Anesthesiol Pain Med [Internet]. 2021 [cited 2025 Jan 5];11(2). Available from: https://brieflands.com/articles/aapm-113350#abstract.
[32] Ghidini A, Vanasche K, Cacace A, Cacace M, Fumagalli S, Locatelli A. Side-effects from epidural analgesia in laboring women and risk of cesarean delivery. AJOG Glob Rep [Internet]. 2024 Feb 1 [cited 2024 Nov 10];4(1):100297. Available from: https://www.sciencedirect.com/science/article/pii/S2666577823001399.
[33] Sood D, Singh P, Pruthi G, Kaur G, Goyal N, Taneja A, et al. Comparative efficacy of intermittent bolus doses of phenylephrine and norepinephrine in preventing maternal bradycardia during cesarean section under spinal anesthesia: A randomized controlled trial. J Obstet Anaesth Crit Care [Internet]. 2024 Dec [cited 2025 Feb 16];14(2):146. Available from: https://journals.lww.com/joac/fulltext/2024/14020/comparative_efficacy_of_intermittent_bolus_doses.8.aspx.
[34] Patel NP, El-Wahab N, Fernando R, Wilson S, Robson SC, Columb MO, et al. Fetal effects of combined spinal-epidural vs epidural labour analgesia: A prospective, randomised double-blind study. Anaesthesia. 2014;69(5):458-67. Wiley Online Library [Internet]. [cited 2024 Nov 8]. Available from: https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/10.1111/anae.12602.
[35] Butwick AJ, Wong CA, Lee HC, Blumenfeld YJ, Guo N. Association between neuraxial labor analgesia and neonatal morbidity after operative vaginal delivery. Anesthesiology. 2021;134(1):52-60.
[36] Shuai F, Jia J, Lin P. Effects of using epidural analgesia during delivery on maternal and infant outcomes. Gynecol Obstet Invest. 2022;87(1):46-53. Available from: https://karger.com/goi/article-abstract/87/1/46/823913/Effects-of-Using-Epidural-Analgesia-during?redirectedFrom=fulltext.
[37] Wlody D. Complications of regional anesthesia in obstetrics. Clin Obstet Gynecol [Internet]. 2003 Sep [cited 2024 Nov 10];46(3):667. Available from: https://journals.lww.com/clinicalobgyn/citation/2003/09000/complications_of_regional_anesthesia_in_obstetrics.19.aspx.
[38] Tamagawa K, Weaver J. Analysing adverse effects of epidural analgesia in labour. Br J Midwifery [Internet]. 2012 Oct [cited 2024 Nov 10];20(10):704-08. Available from: https://www.magonlinelibrary.com/doi/abs/10.12968/bjom.2012.20.10.704.
[39] Parnass SM, Schmidt KJ. Adverse effects of spinal and epidural anaesthesia. Drug Saf. 1990;5(3):179-94. | Drug Safety [Internet]. [cited 2025 Jan 27]. Available from: https://link.springer.com/article/10.2165/00002018-199005030-00003.

PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Anaesthesiology, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Sawangi, Wardha, Maharashtra, India.
2. Junior Resident, Department of Anaesthesiology, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Sawangi, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Neeta Verma,
Professor, Department of Anaesthesiology, Jawaharlal Nehru Medical College,
Datta Meghe Institute of Higher Education and Research, Sawangi,
Wardha-442004, Maharashtra, India.
E-mail: neetachaudhary1234@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Nov 12, 2024
- Manual Googling: Jan 08, 2025
- iThenticate Software: Mar 05, 2025 (14%)

ETYMOLOGY: Author Origin

EMENDATIONS: 8

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Nov 11, 2024**
Date of Peer Review: **Dec 10, 2024**
Date of Acceptance: **Mar 07, 2025**
Date of Publishing: **Apr 01, 2025**