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Original Research Article

A study on epidural analgesia in labour and its foetomaternal outcomes in a tertiary care centre

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ABSTRACT

Background: Epidural analgesia is considered the most effective method for labour pain relief. However, concerns persist regarding its influence on labour progression, operative delivery and neonatal outcomes. This study evaluated foetomaternal outcomes associated with epidural labour analgesia.
Methods: This prospective observational study was conducted over a period of eleven months in a tertiary care teaching hospital. Sample size was calculated using nMaster software with 80% power and 95% confidence, yielding a minimum of 34 participants per group; 50 women were enrolled in each group (total n=100) to enhance power. Parturients were allocated into epidural (n=50) and non-epidural (n=50) groups. Maternal outcomes included pain scores assessed by the Numerical Rating Scale (NRS), duration of labour stages and mode of delivery. Neonatal outcomes included Apgar scores at 1 and 5 minutes and neonatal intensive care unit (NICU) admissions. Statistical analysis was performed using Student's t-test and Chi-square test, with $p<0.05$ considered significant.
Results: Pain scores were significantly lower in the epidural group at all measured intervals after 15 minutes ($p<0.0001$). The duration of the first and second stages of labour was significantly prolonged in the epidural group. There was no statistically significant difference in caesarean section rates, instrumental deliveries, Apgar scores or NICU admissions between groups. Maternal complications were minimal and comparable.
Conclusions: Epidural labour analgesia provides effective pain relief without increasing caesarean section rates or adversely affecting neonatal outcomes, although it is associated with a modest prolongation of labour.

Keywords: Epidural analgesia, Foetomaternal outcome, Labour pain, Neonatal outcome, 11 point-Numerical Rating Scale

INTRODUCTION

Labour pain is a multifactorial physiological process resulting from uterine contractions, cervical dilatation and stretching of the birth canal. It is frequently described as one of the most intense forms of pain experienced by women. Effective pain control during labour is a fundamental component of quality intrapartum care. Inadequately managed pain may lead to maternal exhaustion, heightened stress responses and potential adverse maternal and foetal physiological effects. Contemporary evidence suggests that appropriate labour analgesia enhances maternal satisfaction and the overall childbirth experience without negatively influencing obstetric outcomes.[1,2] The physiological consequences of severe labour pain include hyperventilation, increased oxygen consumption and elevated circulating catecholamines.[3,4] These stress-mediated responses may reduce uteroplacental perfusion and impair foetal oxygenation. Additionally, increased maternal heart rate and blood pressure fluctuations can occur secondary to sympathetic activation.[3] Persistent severe pain may also contribute to metabolic acidosis due to increased lactate production, particularly during the second stage of labour.[3] Beyond physiological effects, poorly controlled labour pain has been associated with heightened anxiety and negative postpartum psychological adjustment.[4] Effective analgesia mitigates these stress responses by reducing

sympathetic activation and stabilizing maternal haemodynamics.[3,4] Epidural analgesia, in particular, has been shown to provide superior pain relief while maintaining cardiovascular stability, thereby potentially improving foetal oxygenation.[5]

Among available methods for labour analgesia, epidural analgesia remains the most reliable and effective technique. It provides superior pain relief compared to systemic opioids and inhalational agents.[6,7] The development of low-dose local anaesthetic–opioid combinations have minimized motor blockade, allowing improved maternal mobility and participation during labour.[8] Despite its well-established efficacy, concerns persist regarding the potential association of epidural analgesia with prolonged labour, increased operative delivery and adverse neonatal outcomes. However, recent evidence indicates that modern epidural regimens do not increase caesarean delivery rates and have minimal impact on neonatal well-being when administered appropriately.[9,10] Furthermore, large population-based studies suggest a possible reduction in severe maternal morbidity among women receiving epidural analgesia.[11]

In low- and middle-income countries, including India, utilization of epidural labour analgesia remains limited due to infrastructural constraints and persistent misconceptions about safety.[12,13] Region-specific prospective data are therefore essential to guide practice within diverse obstetric settings.[14] The present study was undertaken to evaluate the foetomaternal outcomes associated with epidural labour analgesia in a tertiary care teaching hospital, with emphasis on pain relief, labour progression, mode of delivery and neonatal outcomes.

METHODS

Study design and setting

This is a Prospective observational study conducted in the Department of Obstetrics and Gynaecology at Ernakulam Medical Centre, Ernakulam district, Kerala State, India which is a tertiary care teaching hospital. Duration of study was from April 2021 to February 2022.

Participants

Booked antenatal patients attending the OPD of the department of Obstetrics and Gynaecology at Ernakulam Medical Centre, beyond 36 weeks of gestation, during the period from April 2021 to February 2022 were taken as target population. As per hospital protocol these patients were counselled regarding various options of labour analgesia, by the Consultant Gynaecologist and detailed patient informative leaflets were given. Those who opted for epidural analgesia, were sent for pre anaesthetic evaluation and counselled by the anaesthetist. Study and control groups were selected from target population, based on inclusion and exclusion criteria. Control group consisted of patients with matching demographic profile, who did not opt for epidural analgesia. To reduce the selection bias, consecutive patients, who went into labour and fitted in the criteria, were enrolled in each group. Written informed consent was obtained from all participants prior to enrolment.

Inclusion criteria

Antenatal patients in the age group 18-40 years, with singleton pregnancy, cephalic presentation with no obvious cephalopelvic disproportion, gestational age of 37 weeks or more, with no contraindication for epidural analgesia, were included in the study.

Exclusion criteria

Patients with multiple pregnancy, malpresentation, antepartum haemorrhage, severe pre-eclampsia, severe foetal growth restriction and those with contraindications like local sepsis, severe anaemia, coagulopathy, pre-existing neurological disease and severe deformity of spine, were excluded from the study.

Sample size

The sample size was calculated based on the primary outcome variable, the duration of the second stage of labour. Mean and standard deviation values for duration of second stage of labour in the epidural group (73.21±32.4 minutes) and non-epidural group (53.5±21.09 minutes), as well as pain scores in the epidural group (1.96±0.79) and non-epidural group (2.75±1.46), were obtained from a previously published study by Anupama et al.[15] Using these values, with a power of 80% and a confidence level of 95%, the minimum required sample size was calculated to be 34 participants per group using nMaster software. To account for possible dropouts and to improve study power, 50 participants were included in each group, resulting in a total sample size of 100.

Study procedure

Baseline demographic details and obstetric history were recorded using a predesigned proforma. All participants underwent a detailed clinical examination and routine obstetric investigations as per institutional protocol. Once the study group of patients, who had given consent for epidural analgesia, went into active labour, anaesthetist was informed. After preloading the patient with 500 ml of ringer lactate solution, epidural catheter was inserted by the anaesthetist under strict aseptic precautions. The analgesia was initiated with a loading dose of local anaesthetic with opioids -10 ml of ropivacaine 0.2% and 50µg fentanyl and maintenance using a continuous infusion of ropivacaine 0.2% with fentanyl 3 µg/ml at a 5 ml/hr rate. Following administration, maternal and foetal parameters were monitored and outcome data were collected systematically. Maternal heart rate, blood pressure and pain scores were monitored every 15 minutes for the first hour following epidural administration and

subsequently every 60 minutes until delivery. Pain intensity during uterine contractions was assessed using the 11-point NRS, where 0 represents no pain and 10 represents the worst imaginable pain (Figure 1). Patients were asked to verbally report their pain score during contractions at predefined time intervals. Pain scores were recorded at 0, 15, 30 and 60 minutes after initiation of epidural analgesia and hourly thereafter. Motor block was assessed by asking the patient to flex the hip and knee joints. Sensory block was evaluated using the pin-prick method. Foetal heart rate monitoring was performed using continuous cardiotocography (CTG). Labour was augmented with intravenous oxytocin infusion when clinically indicated, based on the progress of labour. Progress of labour was monitored using a partograph. Cervical dilatation was assessed every four hours. Uterine contractions were monitored and recorded every 30 minutes.

The duration of first, second and third stages of labour was recorded for all participants. Mode of delivery was documented as spontaneous vaginal delivery, instrumental vaginal delivery or caesarean section and indications for operative intervention were noted. All neonates were assessed by a paediatrician at birth. Birth weight was recorded and Apgar scores were assigned at 1 and 5 minutes. The need for NICU admission was documented. All collected data were recorded in a structured format and subsequently analysed to compare maternal and neonatal outcomes between the two groups.

RESULTS

Statistical analysis was performed using SPSS version 17. Continuous variables were expressed as mean±standard deviation (SD) and categorical variables as frequencies and percentages. Student's t-test for normal data or Mann-Whitney U test for skewed data was applied for continuous variables, while Chi-square or Fisher's exact test was used for categorical variables. A p value <0.05 was considered statistically significant.

Baseline maternal characteristics

Baseline maternal characteristics were comparable between the two groups (Table 1). The mean maternal age was 28.60±2.65 years in the epidural group and 27.98±2.66 years in the non-epidural group (p=0.246). There were no statistically significant differences in mean maternal height (156.80±6.60 cm vs 158.02±5.54 cm; p=0.319), mean maternal weight (68.94±9.40 kg vs 72.14±12.52 kg; p=0.151) or mean gestational age at delivery (38.26±0.63 weeks vs 38.23±0.64 weeks; p=0.838). The distribution of primigravida and multigravida women was similar in both groups. Epidural group comprised of 42 (84%) primigravida and 8 (16%) multigravidas while nonepidural comprised of 40 (80%) primigravida and 10 (20 %) multigravida women. The p value was 0.603 which was statistically not significant.

Maternal vital parameters

Maternal vital parameters were comparable between the two groups (Table 2). The mean pulse rate was 79.44±5.61 beats/min in the epidural group and 80.00±5.73 beats/min in the non-epidural group (p=0.623). The mean systolic blood pressure was 116.08±7.42 mmHg versus 116.52±8.08 mmHg (p=0.777) and the mean diastolic blood pressure was 69.96±5.82 mmHg versus 70.44±5.57 mmHg (p=0.800) in the epidural and non-epidural groups, respectively. No case of severe hypotension requiring medical intervention, was observed in the epidural group. Pain intensity was assessed using an 11-point scale (0=no pain, 10=worst imaginable pain) and compared between the study and control groups (Figure 1). Mean NRS pain scores at 0, 15, 30, 60, 120 and 180 minutes in the epidural and non-epidural groups. The epidural group demonstrated a statistically significant reduction in pain scores from 15 minutes onwards compared to the non-epidural group (p<0.0001), indicating sustained analgesic efficacy (Figure 2).

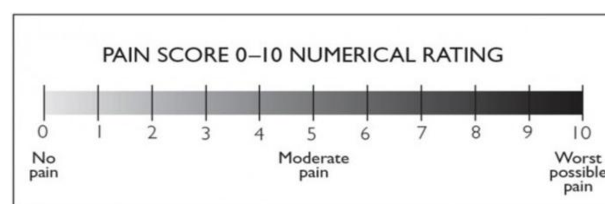

Figure 1: 11-point Numeric Rating Scale for assessment of labour pain.

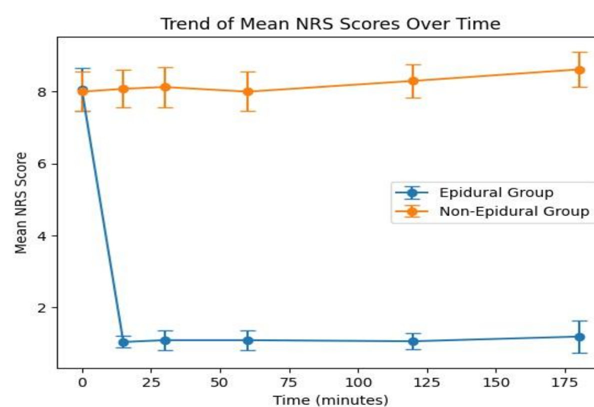

Figure 2: Trend in mean NRS pain scores over time between groups.

Pain assessment

Pain intensity assessed using the NRS score, demonstrated a marked reduction in pain scores in the epidural group compared to the non-epidural group (Table 3). Baseline pain scores at 0 minutes were comparable between groups (p=0.692). However, at 15 minutes and at all subsequent time intervals (30, 60, 120 and 180 minutes), the epidural group showed significantly lower pain scores compared to the non-epidural group (all p<0.0001). The trend in mean

NRS pain scores over time is illustrated in Figure 2, which demonstrates sustained and significant analgesic efficacy in the epidural group.

Duration of labour

The duration of labour is summarized in Table 4. The mean duration of the first stage of labour was significantly longer in the epidural group compared to the non-epidural group (278.13±39.80 minutes vs 248.75±52.07 minutes; p=0.004). Similarly, the second stage of labour was significantly prolonged in the epidural group (48.88±6.65 minutes vs 42.38±8.91 minutes; p<0.0001). There was no statistically significant difference in the duration of the third stage of labour between the two groups.

Mode of delivery

The distribution of mode of delivery was comparable between the two groups (Table 5). In the epidural group, 40 women (80%) delivered vaginally, including 10 (20%) instrumental deliveries, while 10 women (20%) underwent caesarean section. In the non-epidural group, 40 women (80%) delivered vaginally, including 8 (16%) instrumental deliveries and 10 women (20%) underwent caesarean section. There was no statistically significant difference in caesarean section rates between the two groups (p=0.802).

Neonatal outcomes

Neonatal outcomes were comparable between the two groups (Table 5). The mean Apgar score at 1 minute was 7.60±0.57 in the epidural group and 7.56±0.67 in the non-epidural group (p=0.980). At 5 minutes, the mean Apgar score was 8.78±0.42 and 8.76±0.43, respectively (p=0.813). NICU admission occurred in 2 neonates (4%) in each group (p=1.000). No significant foetal heart rate abnormalities were observed in either group.

Maternal complications

Minor complications were noted in a small number of cases. Three women in the epidural group experienced vomiting, while one woman in the non-epidural group developed atonic postpartum haemorrhage, which was managed medically. No cases of severe hypotension, post-dural puncture headache, persistent backache or other major complications were observed.

Table 1: Baseline maternal characteristics of study participants.

Variable	Epidural group (n=50)	Non-epidural group (n=50)	P value*
Maternal age (years)	28.60±2.65	27.98±2.66	0.246
Maternal height (cm)	156.80±6.60	158.02±5.54	0.319
Maternal weight (kg)	68.94±9.40	72.14±12.52	0.151
Gestational age at delivery (weeks)	38.26±0.63	38.23±0.64	0.838
Primigravida / Multigravida, n (%)	42 (84%) / 8 (16%)	40 (80%) / 10 (20%)	0.603

Values expressed as mean±SD or number (%). *Student's t-test for continuous variables and Chi-square test for categorical variables. p<0.05 considered statistically significant.

Table 2: Comparison of maternal vital parameters between groups.

Parameter	Epidural group (n=50)	Non-epidural group (n=50)	P value*
Pulse rate (beats/min)	79.44±5.61	80.00±5.73	0.623
Systolic blood pressure (mmHg)	116.08±7.42	116.52±8.08	0.777
Diastolic blood pressure (mmHg)	69.96±5.82	70.44±5.57	0.674

Values expressed as mean±SD. *Student's t-test used for comparison. p<0.05 considered statistically significant.

Table 3: Comparison of NRS pain scores between groups.

Time (minutes)	Group	Mean±SD	Median (IQR)	Z value†	P value*
0	Epidural	8.05±0.60	8 (8–8)	-0.396	0.692
	Non-epidural	8.00±0.55	8 (8–8)		
15	Epidural	1.03±0.16	1 (1–1)	-8.42	<0.0001
	Non-epidural	8.08±0.53	8 (8–8)		
30	Epidural	1.08±0.27	1 (1–1)	-8.83	<0.0001
	Non-epidural	8.13±0.56	8 (8–8)		
60	Epidural	1.08±0.27	1 (1–1)	-8.313	<0.0001
	Non-epidural	8.00±0.55	8 (8–8)		
120	Epidural	1.05±0.22	1 (1–1)	-8.366	<0.0001
	Non-epidural	8.30±0.46	8 (8–8)		
180	Epidural	1.18±0.45	1 (1–1)	-8.178	<0.0001
	Non-epidural	8.62±0.49	8 (8–9)		

Values expressed as mean±SD and median (interquartile range). *Mann–Whitney U test used for comparison. †Z value derived from Mann–Whitney U test. p<0.05 considered statistically significant.

Table 4: Duration of stages of labour between groups.

Stage of labour	Epidural group (n=50)	Non-epidural group (n=50)	P value*
First stage (minutes)	278.13±39.80	248.75±52.07	0.004
Second stage (minutes)	48.88±6.65	42.38±8.91	<0.0001
Third stage (minutes)	7.08±1.90	7.40±1.79	0.363

Values expressed as mean±SD. *Student's t-test used for comparison. $p<0.05$ considered statistically significant.

Table 5: Mode of delivery and neonatal outcomes.

Variable	Epidural group (n=50)	Non-epidural group (n=50)	P value*
Normal vaginal delivery, N (%)	30 (60%)	32 (64%)	0.680
Instrumental delivery, N (%)	10 (20%)	8 (16%)	0.603
Caesarean section, N (%)	10 (20%)	10 (20%)	1
Apgar score at 1 minute	7.60±0.57	7.56±0.67	0.980
Apgar score at 5 minutes	8.78±0.42	8.76±0.43	0.813
NICU admission, N (%)	2 (4%)	2 (4%)	1

Values expressed as mean±SD or number (%). *Chi-square or Fisher's exact test for categorical variables, Student's t-test for continuous variables. $p<0.05$ considered statistically significant.

DISCUSSION

This prospective observational study assessed the impact of epidural labour analgesia on maternal and neonatal outcomes by comparing parturients who received epidural analgesia with those who did not. The findings demonstrate that epidural labour analgesia provides highly effective pain relief without increasing caesarean section rates or compromising neonatal outcomes.

Pain scores were significantly lower in women receiving epidural analgesia, confirming its superiority over non-epidural methods.[1,2,6] Effective analgesia likely contributed to improved maternal comfort and attenuation of stress-related physiological responses.[8] A statistically significant prolongation of the first and second stages of labour was observed in the epidural group. Similar observations have been reported in prior cohort studies.[10,16] Reduced expulsive effort and alterations in pelvic floor muscle tone have been proposed as possible mechanisms. Importantly, this prolongation did not translate into higher operative delivery rates.

Caesarean section rates were comparable between groups, supporting existing evidence that modern low-dose epidural techniques do not increase caesarean delivery risk.[9,17] Additionally, findings from tertiary care centres in India report similar mode-of-delivery patterns among women receiving epidural analgesia.[22] Although instrumental vaginal delivery was slightly more frequent in the epidural group, the difference was not statistically significant and is consistent with previous reports.[18,19] Neonatal outcomes, including Apgar scores and NICU admissions, were similar in both groups. These findings align with contemporary literature demonstrating the neonatal safety of epidural labour analgesia.[11,20] The absence of significant foetal heart rate abnormalities further supports its safety profile.[21]

The strengths of the present study include its prospective design, standardized monitoring protocols and inclusion of both maternal and neonatal outcome measures. However, certain limitations should be acknowledged. The single-centre design and relatively small sample size may limit generalizability and the non-randomized allocation may introduce selection bias. Nevertheless, the findings contribute valuable region-specific evidence supporting the safe integration of epidural labour analgesia into routine obstetric practice in tertiary care settings.

CONCLUSION

Epidural labour analgesia provides effective pain relief without increasing caesarean section rates or adversely affecting neonatal outcomes, although it is associated with a modest prolongation of labour.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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