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Original Research Article

Labour epidural analgesia and maternal and neonatal outcome

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ABSTRACT

Background: This study was done to determine the maternal and neonatal outcomes in parturient who were administered with labour epidural analgesia. Primary objectives include the comparison of time to deliver after insertion of the epidural catheter at less than 4 cm and more than 4 cm of cervical dilatation, to determine the requirement of assistance for normal vaginal delivery, and also to determine adverse maternal outcomes.
Methods: The study was conducted at Arokya Women's Centre, Salem, Tamil Nadu, India. The data was collected from medical records department, between July 2023 and June 2024. After obtaining written and informed consent, 749 parturient, who were willing for receiving labour epidural analgesia, were included in our study.
Results: In our study, majority of the parturient received labour epidural analgesia during their first stage of labour, i.e. less than 4 cm of cervical dilatation. The time to deliver in this age group is found to be more 465.4±393.3 minutes, as compared to those who were provided with labour epidural analgesia during their second stage of labour, 130.4±184, which was statistically significant (p value- 0.000).
Conclusions: We conclude that labour epidural analgesia, when administered between 1 and 4 cm of cervical dilatation, was helpful for parturient to have a pain-free, quicker delivery. We also observed that labour epidural did not cause an increased occurrence of post-partum haemorrhage among parturient and NICU admission among neonates.

Keywords: Epidural analgesia, Labor analgesia, Maternal and neonatal outcome

INTRODUCTION

The mechanisms responsible for pain and analgesia were explained by Melzack and Wall, through the gate control theory of pain, more than 50 years ago. It was described originally as regulation of pain signals originating from the peripheral nerves to the spinal cord, resulting from the activity of other peripheral nerves, interneurons in the spinal cord, and the central supraspinal centres. It was later refined to include the concept of a neuromatrix.[1]

Labour pain, as suggested by Dick-read, was not considered painful by the women in primitive cultures as it was a natural process which should be handled with education and preparation instead of using pain medications. It was Lamaze who popularized the method of psychoprophylaxis, to be used as a method to prepare the parturient for birth. It is this method that forms the basis for prepared childbirth, prevalent in the developed world.[1]

Among all the pain a woman would experience in her lifetime, the pain of childbirth is considered to be the most severe pain. It is suggested by the American College of Obstetricians and Gynecology (ACOG), that if there is no contraindication, all parturients should be made available with labour analgesia, with a goal of ensuring painless labour without any significant adverse maternal outcomes and safe fetal outcomes.[2]

There are non-pharmacological and pharmacological methods of labour analgesia. Among the non-pharmacological methods, there are emotional support, touch and massage, therapeutic use of heat and cold,

hydrotherapy and vertical position which involve minimal training and equipment. Specialized training and equipment are essential for techniques such as biofeedback, intradermal water injection, transcutaneous nerve stimulation (TENS), acupuncture and hypnosis.[1]

Pharmacological method majorly involves utilizing opioids for providing analgesia. The gold standard for labour analgesia is epidural analgesia.[4] In this technique, a catheter is threaded into the epidural space with the help of an epidural needle, and is positioned at such a space ensuring effective analgesia both during the first and second stages of labour. The first stage of labour involves pain transmitted from the afferents with peripheral terminals in the cervix and lower uterine segment, present between the dermatomes T10 and L1. This transmission occurs through the Aδ and C fibres. Pain during the second stage of labour is transmitted via the Aδ and C fibres along with the parasympathetic bundle between dermatomes S2 and S4.[3]

The first stage pain being visceral in origin can be best relieved with narcotics. The second stage pain is somatic in origin and requires a local anaesthetic as used in the neuraxial technique. The epidural technique using a local anesthetic along with a low dose of an opioid is considered the most versatile technique.[3]

The drug can either be administered as a continuous epidural infusion (CEI) or as programmed intermittent epidural boluses (PIEB). The addition of an opioid to the local anaesthetic makes the drug solution more dilute, as it is proven that more dilute local anesthetic solutions facilitate normal spontaneous vaginal deliveries.[4]

This study was conducted at Arokya Women's Centre, Salem, Tamil Nadu, India, a centre that prioritizes in providing a painless labour experience to the parturients, while ensuring safe maternal and fetal outcomes.

Aims and objectives

To determine the maternal and neonatal outcomes in parturients who were administered with labour epidural analgesia. Primary objectives include the comparison of time to deliver after insertion of the epidural catheter at less than 4 cm and more than 4 cm of cervical dilatation, to determine the requirement of assistance for normal vaginal delivery, and also to determine adverse maternal outcomes including postpartum hemorrhage and failure in progression of labour, thus resulting in emergency lower segment cesarean section (LSCS). Secondary objectives include the determination of fetal outcomes by assessing the number of babies requiring neonatal intensive care unit (NICU) admission immediately after birth.

METHODS

The study was conducted at Arokya Women's Centre, Salem, Tamil Nadu, India. The data was collected from medical records department, between July 2023 and June 2024. After obtaining written and informed consent, 749 parturients, who were willing for receiving labour epidural analgesia, were included in our study. Inclusion criteria included nulliparous and multiparous women with singleton or twin pregnancy, women who were admitted for trial of labour after caesarean section (TOLAC), in both latent (uneffaced to 4 cm of cervical dilatation) and active phase of labour (>4 cm of cervical dilatation) with a good pattern of fetal heart rate, American Society of Anesthesiologists (ASA) physical statuses I and II, and those who requested for labour epidural analgesia. Exclusion criteria were contraindications to epidural catheterization, namely, bleeding diathesis or coagulation disorders, allergy to local anaesthetic drug, active infection at the epidural site, anatomical abnormality of the spine, neurologic or neuromuscular disorders, etc., ASA status >II, evidence of abnormal fetal heart rate pattern, and women who were not willing for labour epidural analgesia.

All parturients were consulted by the anesthesiologist prior to epidural catheterization, for conducting pre-anesthetic evaluation. Investigations such as routine haemogram including haemoglobin level and platelet count, Bleeding Time (BT) and Clotting Time (CT) were assessed. The procedure was explained to all parturients, who were willing for labour epidural analgesia, in order to alleviate apprehension. All parturients were cannulated using an 18G intravenous catheter. After shifting the patient inside the operating room, baseline vitals monitoring, including heart rate, SpO_2, blood pressure and ECG, were assessed. In sitting position, the spinal region was cleaned and draped. After identifying the L3-L4 space, skin was infiltrated with 3ml of 2% injection lignocaine. Using an 18G Tuohy epidural needle, the epidural space was identified by loss of resistance technique to saline and an 18G epidural catheter was threaded and secured appropriately. Test dose was given using 3 ml of 1% injection lignocaine. Following this, parturients were administered with programmed intermittent epidural boluses of 10 ml containing 0.0625% bupivacaine and 20 mcg of fentanyl. This mixture was repeated every 30 minutes, while monitoring the vitals throughout the process. Fetal heart rate was also monitored throughout using cardiotocography. Labour progress was assessed every 4 hours by pelvic examination and cervical dilatation of at least 1 cm/hour. If necessary, the decision to proceed with LSCS was also made, according to maternal and fetal indications. When there was none progression of labour because of cephalopelvic disproportion, fetal distress and meconium-stained amniotic fluid causing fetal distress, the decision to proceed with LSCS was immediately made.

The time taken to deliver after the insertion of the epidural catheter between women with cervical dilatations of <4 cm and >4 cm was assessed. Also, the requirement of instrumentation (forceps) to deliver vaginally was assessed. Post delivery, mothers were assessed for postpartum hemorrhage and they were managed either medically or with surgical B-lynch suturing. Fetal

outcomes were assessed by estimating the birth weight and the need for NICU admission.

RESULTS

The demographic characteristics of the respondents are summarized in Table 1. The mean age of the participants was 24.6±3.7. The majority (62.8%) was less than 25 years of age and 37.2% were more than 25 years of age. 74.1% were primi gravida and 25.9% were multi gravida.

Table 1: Demographic information of the parturients.

Variables	Mean±SD or N (%)
Age (years)	24.6±3.7
≤25	470 (62.8)
≥25	279 (37.2)
Gravida	
Primi	555 (74.1)
Multipara	194 (25.9)

Table 2: Intrapartum and maternal outcomes.

Variables	Mean±SD or N (%)
Epidural insertion	
1 to 4 cm	720 (96.1)
>4 cm	29 (3.9)
PPH	
Yes	8 (1.1)
No	741 (98.9)
NICU	
Yes	4 (0.5)
No	745 (99.5)
Time to deliver (minutes)	452.5±392.6
Mode of delivery	
Normal	603 (80.5)
LSCS	77 (10.3)
Instrumental	69 (9.2)
Birth weight	
<2.5 kg	114 (15.2)
2.5-3.5 kg	614 (82.0)
>3.5 kg	21 (2.8)
Comorbidity	
Yes	200 (26.7)
No	549 (73.3)

The intrapartum and maternal outcomes of the parturients are summarized in the Table 2. In 96.1% cases, epidural was inserted when cervical dilation was between 1 to 4 cm, with only 3.9% receiving it after dilation exceeded 4 cm. Postpartum hemorrhage (PPH) was reported only in 1.1% of cases. Neonatal intensive care unit (NICU) admissions were minimal, occurring in only 0.5% of cases. The mean time to delivery was 452.5±392.6 hours. 80.5% of the parturients who received epidural analgesia delivered via normal vaginal delivery, while 9.2% required instrumental delivery and 10.3% underwent lower segment cesarean section (LSCS). Regarding birth weight, 82.0% of newborns weighed between 2.5-3.5 kg, 15.2% weighed less than 2.5 kg, and 2.8% exceeded 3.5 kg. Comorbidities were present in 26.7% of parturients. These findings indicate favourable maternal and neonatal outcomes with low complication rates.

Table 3: Comparison of maternal outcomes vs time to deliver.

Variables	Time to deliver (minutes) Mean±SD	P value
Epidural insertion		
1 to 4 cm	465.4±393.3	0.000*
>4 cm	130.4±184.1	
PPH		
Yes	360.0±219.3	0.194
No	453.5±394.0	
NICU		
Yes	258.8±228.3	0.375
No	453.5±393.1	
Birth weight		
<2.5 kg	403.2±335.6	0.040*
2.5-3.5 kg	460.2±402.1	
>3.5 kg	493.4±391.7	
Comorbidity		
Yes	458.0±339.3	0.377
No	450.3±410.6	

*Statistically significant

Table 3 compares various maternal outcomes and factors influencing the time to deliver. Epidural insertion timing significantly affected delivery duration, with earlier insertion (1 to 4 cm dilation) associated with a longer mean time to deliver (465.4±393.3) compared to insertion at >4 cm (130.4±184.1, p=0.000). Birth weight showed a statistically significant association, where higher weights correlated with increased delivery times (p=0.040). While increased delivery time influenced postpartum hemorrhage (PPH) and NICU admissions, these differences were not statistically significant (p values: 0.194 and 0.375 respectively). These findings highlight the role of epidural timing, mode of delivery, and birth weight in influencing labour duration.

DISCUSSION

In our study, majority of the parturients received labour epidural analgesia during their first stage of labour, i.e. less than 4 cm of cervical dilatation. The time to deliver in this age group was found to be more 465.4±393.3 minutes, as compared to those who were provided with labour epidural analgesia during their second stage of labour, 130.4±184, which was statistically significant (p value- 0.000). In contrast to our study, Zhang et al conducted a meta-analysis, in which they concluded that epidural analgesia increased both first and second stage labour length.[5]

In our study, the parturients who developed postpartum hemorrhage (n=8) had an average 360.0±219.3 minutes to

deliver, whereas parturients who did not develop PPH, had an average 453.5±394.0 minutes to deliver. But it was not statistically significant (p value- 0.194), implying the duration to deliver post epidural insertion was not related to the development of PPH. This was similar to the study done by Guglielminotti et al, in which they concluded that, the risk for occurrence of severe maternal morbidity, including PPH was reduced with neuraxial analgesia and was similar between low-risk and high-risk women between non-Hispanic white women and racial and ethnic minority women.[6]

The number of babies requiring neonatal intensive care unit (NICU) admission post-delivery during our study period was very minimal (n=4). The time to deliver in parturients who delivered these 4 babies was 258.8±228.3 minutes, whereas in those women whose babies did not require NICU admission, the average time to deliver was 453.5±393.1 (p value- 0.375), which was not statistically significant. This was similar to the study conducted by He, in which they observed that there was no statistical significance in the rate of abnormal neonatal APGAR score and the rate of neonatal asphyxia between the test group (246 parturients), who received labour epidural analgesia and the control group (226 parturients), who did not receive labour epidural analgesia.[7]

The time to deliver was increased in parturients carrying babies weighing >3.5 kg, than those with 2.5-3.5 kg and <2.5 kg (403.2±335.6 minutes, 460.2±402.1 minutes, 493.4±391.7 minutes, respectively. P value- 0.040), which was statistically significant.

Parturients with co-morbid conditions (n=200) such as gestational diabetes, gestational hypertension, bronchial asthma, hypothyroidism and seizure disorders did not have a statistically significant prolonged time to deliver (p value- 0.377).

CONCLUSION

From our study, we conclude that labour epidural analgesia, when administered between 1 and 4 cm of cervical dilatation, was helpful for parturients to have a pain-free, quicker delivery. We also observed that labour epidural did not cause an increased occurrence of post-partum haemorrhage among parturients and NICU admission among neonates, as it was concluded in theories over the years. The decision to administer labour epidural analgesia, at the right time and to the right patient, is key in contributing a pain free labour process to the parturients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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