Assessing the efficacy of epidural analgesia on the labor duration (1st and 2nd stage labor) and neonatal outcomes concerning APGAR scores at 5 minutes

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ABSTRACT

Background: Present epidural regimens provide almost good to excellent pain relief in nearly 90% of subjects and for remaining 10% find analgesia inadequate. Risk factors predisposing to inadequate analgesia or breakthrough pain include improper interval between dosings, higher BMI, heavier babies, and nulliparity.

Aim: The present study aimed to assess the efficacy of epidural analgesia on the labor duration (1st and 2nd stage labor) and neonatal outcomes concerning APGAR scores at 5 minutes.

Methods: The study included 274 subjects in the epidural group and 300 age and gender-matched subjects in the control group. Routine intrapartum management of females included assessment every 4 hours or hourly when needed to assess labor progress. Neonatal outcomes were assessed as APGAR scores in newborns at 5 minutes. APGAR scores of more than 7 were taken as normal values, whereas, neonates with <7 scores needed medical intervention.

Results: 1st and 2nd stages of labor were significantly lesser in the epidural group compared to the non-epidural group with p<0.001 and 0.007. APGAR scores of <7 were seen in no subject from either group. APGAR score of 7 was seen in no subject from the epidural group and 0.7% (n=2) subjects from the non-epidural group. APGAR score of 8 was recorded in 1.5% (n=4) subjects from the epidural and 0.7% (n=2) subjects from the non-epidural group. APGAR scores of 9 were seen in 98.5% (n=270) subjects from the epidural group and 98.7% (n=296) subjects from the non-epidural group respectively (Table 3). On comparing mean APGAR scores in two groups of study subjects, the mean APGAR scores in the epidural group were 8.97±0.14 and 8.96±0.185 in the non-epidural group depicting non-significant difference with p=0.916 NICU (neonatal intensive care unit) was needed in 52.6% (n=144) subjects from epidural group and in 52% (n=156) subjects from non-epidural group.

Conclusions: The present study concludes that 1st and 2nd stage labor duration was significantly lesser with epidural analgesia along with no adverse neonatal outcomes. The present study showed an increase in instrumental vaginal deliveries along with having no deleterious effects on the mother or the neonate subjects that received epidural analgesia.

Keywords: APGAR score, epidural analgesia, neonates, labor duration

INTRODUCTION

With the introduction of different techniques and compounds, obstetric anesthesia has become a complex entity targeting optimum pain relief along with neonatal and maternal safety. Selecting analgesia type, for pregnant females needs an understanding of maternal physiology change during pregnancy, normal maternal physiological pain response, and pain source during labor. Labor pain is described as a unique response to different stimuli which are individualized when interpreted and received. Factors affecting include social and cultural background, cognition, motivation, and maternal emotion.[1] Pain in 1st labor stage is owing to cervical dilatation and uterine contractions transmitted by visceral afferent fibers from T10 to L1 entering through the spinal cord. In 2nd labor stage, pain is due to perineum stretching owing to painful stimulus via sacral nerves from S2 to S4 and pudendal nerve. Pain perception can be different in different persons and is based on support from healthcare personnel and family, antenatal preparations from antenatal classes, maternal age, and other factors. Pain perception is increased via fear in primi or nulliparous females.[2]

Maternal physiological pain responses are complex and present interpersonal variations. This can include hyperventilation causing increased blood pressure owing to peripheral vascular resistance and augmented cardiac output, increased oxygen consumption due to augmented metabolic rate, and hyperventilation causing hypocarbia. Peridural or epidural space has Baston's plexus (internal vertebral plexus), fat, and areolar tissues. The intervertebral plexus gets engorged during pregnancy reducing the volume. The lumbar part of the epidural space is utilized in obstetric analgesia. Epidural analgesia involves administering dilute local anesthesia with/without opioid analgesics acting on spinal nerve roots as they cross the spinal cord and epidural space.[3]

Present epidural regimens provide almost good to excellent pain relief in nearly 90% of subjects and for remaining 10% find analgesia inadequate. Risk factors predisposing to inadequate analgesia or breakthrough pain include improper interval between dosings, higher BMI, heavier babies, and nulliparity. This can be attributed to sympathetic blockade by analgesic agents given epidurally. This can be prevented and reduced by rapid infusion of 500-100mL crystalloids and maintaining lateral position. It is seen in a few studies that hypotension is more common in females with pulse pressure <45mmHg.[4]

Fetomaternal infection or dysregulation in maternal body temperature can lead to maternal fever. Fever was found to be associated with selective blockage of warm stimulus, impairment of peripheral thermos-receptor input to CNS, alteration of hypothalamic thermoregulatory set point, and placental inflammation or infection.[5] Existing literature data has depicted that epidural anesthesia was associated with short-term back pain and persistent back pain is uncommon. However, few studies reported no association between epidural and long-term backache.[6] The present study aimed to assess the efficacy of epidural analgesia on the labor duration (1st and 2nd stage labor) and neonatal outcomes concerning APGAR scores at 5 minutes.

MATERIALS AND METHODS

The present prospective clinical study aimed to assess the efficacy of epidural analgesia on the labor duration (1st and 2nd stage labor) and neonatal outcomes concerning APGAR scores at 5 minutes. The study subjects were from the Department of Obstetrics and Gynecology of the Institute. Verbal and written informed consent were taken from all the subjects before participation.

The inclusion criteria for the study were nulliparous subjects with no previous pregnancies >20 weeks, singleton pregnancies with vertex presentation, ≥36 weeks of gestational age, cervical dilatation >3cm, adequate contraction with or without oxytocin, and voluntary opting for epidural analgesia. The exclusion criteria for the study were subjects with conversion to spinal block, local infiltration at the site of epidural, maternal sepsis, coagulopathies, major fetal anomalies, obese subjects with BMI ≥30 based on pre-pregnant weight, IUD, hypertension and associated disorders, previous CS, cervical incompetence, CPD (cephalon-pelvic disproportion), malpresentation, abnormal placentation, and multiple pregnancies.

Females that fulfilled the inclusion criteria were finally included. The study included 274 subjects in the epidural group and 300 age and gender-matched subjects in the control group.

In the epidural group, a comprehensive pre-anesthetic checkup was done. Once subjects chose epidural, subjects were placed in a lateral position after establishing the i.v line. The lower back was draped and prepared. Under strict aseptic and sterile conditions, epidural space at L2-L3 or L3-L4 intervertebral space was assessed using the resistance loss technique with an 18-gauge needle. The epidural catheter was then placed 4-5cm into the epidural space followed by administration of 3ml of 2% lidocaine with adrenaline. The subjects were then monitored for 5 minutes.

Maternal hypotension assessed as a decrease in blood pressure by >20% from baseline or motor blockade development in legs showed intrathecal catheter placement under spinal anesthesia and the subject was excluded from the study. However, maternal tachycardia, taken as heart rate increase by 10% from baseline indicated intravascular catheter placement and needed catheter repositioning. Test dose after confirming catheter position not in intravascular or intrathecal space, 5ml of 0.15% ropivacaine was given as bolus dose along with 5µg Fentanyl as per the need of the subject.

To maintain analgesia, 2nd bolus of 0.15% of 5ml ropivacaine and 5µg Fentanyl and a further 0.15% of 5ml ropivacaine was given on demand of the subject. After epidural analgesia, sensory blockade levels, heart rate, and maternal blood pressure were assessed throughout the labor. Hypotension episodes (systolic blood pressure decrease from >20% from baseline) if seen were managed and recorded by rapid intravenous infusion of fluid, 3mg Mephentermine as intravenous boluses, and left uterine displacement. Bradycardia episodes (<60/minute) were managed using 0.6mg of intravenous atropine, as needed. All subjects were closely monitored and closed until delivery.

Subjects from the control group included age and gender-matched subjects who did not request any analgesia. Obstetric management was identical in the two groups. Labor progress was recorded on a modified partograph. All pregnant females were managed based on the study protocol by

trained medical staff experienced and expert in the field. Routine intrapartum management of all pregnant females included examination at every fourth hour and hourly, when needed to assess labor progress. A decision concerning cesarean or instrumental vaginal deliveries was made by Gynecologist based on fetal or maternal indications. Demographic data in two study groups was assessed and compared.

Neonatal outcomes were assessed as APGAR scores in newborns at 5 minutes. APGAR scores of more than 7 were taken as normal values, whereas, neonates with <7 scores needed medical intervention.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 16.0 (SPSS Inc., Chicago, USA) for assessment of descriptive measures, independent t-test, Mann Whitney U test, and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The present prospective clinical study aimed to assess the efficacy of epidural analgesia on the labor duration (1st and 2nd stage labor) and neonatal outcomes concerning APGAR scores at 5 minutes. The study included 274 subjects in the epidural group and 300 age and gender-matched subjects in the control group. In the epidural group, 1st stage of labor was of mean duration of 212.2±159.7 minutes compared to 271.2±131.3 minutes in the non-epidural group which was significantly higher in a non-epidural group with p<0.001. The 2nd stage of labor was 20.3±9.1 minutes in the epidural group which was significantly lesser when compared to the non-epidural group where it was 23.5±9.7 minutes with p=0.007 as shown in Table 1.

On assessing the maternal obstetric complications in two groups of study subjects, no complications were seen in 86.1% (n=236) subjects from the epidural and 88.7% (n=266) subjects from the non-epidural group. T3 tear was seen in 2.9% (n=8) and 1.3% (n=4) subjects from epidural and non-epidural groups. T2 tear was seen in 2.9% (n=8) and 6.7% (n=20) subjects from epidural and non-epidural groups respectively. Lateral wall laceration was seen in 2.2% (n=6) of subjects from the epidural and no subjects from the non-epidural group. MROP (manual removal of the placenta) was seen in 1.5% (n=4) and 1.3% (n=4) subjects from epidural and non-epidural groups respectively. Atonic PPH (post-partum hemorrhage) was reported in 4.4% (n=12) and 2% (n=6) subjects from epidural and non-epidural groups respectively as summarized in Table 2.

For APGAR scores at 5 5-minute distribution in two groups of study subjects, APGAR scores of <7 were seen in no subject from either group. APGAR score of 7 was seen in no subject from the epidural group and 0.7% (n=2) subjects from the non-epidural group. APGAR score of 8 was recorded in 1.5% (n=4) subjects from the epidural and 0.7% (n=2) subjects from the non-epidural group. APGAR scores of 9 were seen in 98.5% (n=270) subjects from the epidural group and 98.7% (n=296) subjects from the non-epidural group respectively (Table 3). On comparing mean APGAR scores in two groups of study subjects, the mean APGAR scores in the epidural group

were 8.97±0.14 and 8.96±0.185 in the non-epidural group depicting non-significant difference with p=0.916 as depicted in Table 4.

On assessing the distribution of birth weight in neonates from the study, birth weight of <2.5 kgs was seen in 10.9% (n=30) and 6.7% (n=20) subjects from epidural and non-epidural groups. Birthweight of 2.5-3.5kgs was seen in 83.2% (n=228) and 84.7% of subjects from epidural and non-epidural groups. Birth weight of >3.5kgs was seen in 5.8% (n=16) subjects from the epidural group and 8.7% (n=26) subjects from the non-epidural group (Table 5). NICU (neonatal intensive care unit) was needed in 52.6% (n=144) subjects from the epidural group and in 52% (n=156) subjects from the non-epidural group (Table 6).

DISCUSSION

The present study assessed 274 subjects in the epidural group and 300 age and gender-matched subjects in the control group. In the epidural group, 1st stage of labor was of mean duration of 212.2±159.7 minutes compared to 271.2±131.3 minutes in the non-epidural group which was significantly higher in a non-epidural group with p<0.001. The 2nd stage of labor was 20.3±9.1 minutes in the epidural group which was significantly lesser when compared to the non-epidural group where it was 23.5±9.7 minutes with p=0.007. These data were similar to the studies of Wang Q et al[7] in 2018 and Wu CY et al[8] in 2005 where authors assessed pregnant females undergoing epidural analgesia with demographic data comparable to the present study.

It was seen that on assessing the maternal obstetric complications in two groups of study subjects, no complications were seen in 86.1% (n=236) subjects from the epidural and 88.7% (n=266) subjects from the non-epidural group. T3 tear was seen in 2.9% (n=8) and 1.3% (n=4) subjects from epidural and non-epidural groups. T2 tear was seen in 2.9% (n=8) and 6.7% (n=20) subjects from epidural and non-epidural groups respectively. Lateral wall laceration was seen in 2.2% (n=6) of subjects from the epidural and no subjects from the non-epidural group. MROP (manual removal of the placenta) was seen in 1.5% (n=4) and 1.3% (n=4) subjects from epidural and non-epidural groups respectively. Atonic PPH (post-partum hemorrhage) was reported in 4.4% (n=12) and 2% (n=6) subjects from epidural and non-epidural groups respectively. These results were consistent with the findings of Leighton BL et al[9] in 2002 and Sharma SK et al[10] in 2004 where maternal obstetric complications similar to the present study were reported by the authors in their respective studies.

The study results showed that for APGAR scores at 5 minutes distribution in two groups of study subjects, APGAR scores of <7 was seen in no subject from either group. APGAR score of 7 was seen in no subject from the epidural group and 0.7% (n=2) subjects from the non-epidural group. APGAR score of 8 was recorded in 1.5% (n=4) subjects from the epidural and 0.7% (n=2) subjects from the non-epidural group. APGAR scores of 9 were seen in 98.5% (n=270) subjects from the epidural group and 98.7% (n=296) subjects from the non-epidural group respectively. On comparing mean APGAR scores in two groups of study subjects, the mean APGAR scores in the epidural group were 8.97±0.14 and 8.96±0.185 in the non-epidural group depicting non-significant differences with p=0.916. These findings were in agreement with the results of Nafisi S[11] in 2006

and Simic M et al[12] in 2017 where authors reported APGAR scores in their studies that were comparable to the present study.

Concerning the distribution of birth weight in neonates from the study, birth weight of <2.5 kgs was seen in 10.9% (n=30) and 6.7% (n=20) subjects from epidural and non-epidural groups. Birthweight of 2.5-3.5kgs was seen in 83.2% (n=228) and 84.7% of subjects from epidural and non-epidural groups. Birth weight of >3.5kgs was seen in 5.8% (n=16) subjects from the epidural group and 8.7% (n=26) subjects from the non-epidural group. NICU (neonatal intensive care unit) was needed in 52.6% (n=144) subjects from the epidural group and in 52% (n=156) subjects from the non-epidural group. These results were by the studies of Antonakou A et al[13] in 2016 and Wang Q et al[14] in 2018 where NICU requirement similar to the present study was reported by the authors in their respective studies.

CONCLUSIONS

Considering its limitations, the present study concludes that 1st and 2nd stage labor duration was significantly lesser with epidural analgesia along with no adverse neonatal outcomes. The present study showed an increase in instrumental vaginal deliveries along with having no deleterious effects on the mother or the neonate subjects that received epidural analgesia. Future longitudinal studies with larger sample sizes and longer monitoring periods are needed to reach definitive conclusions.

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S. No	Groups	1st stage Mean ± S. D	Mann-Whitney U score	p-value	2nd stage Mean ± S. D	Mann-Whitney U score	p-value
1.	**Epidural**	212.2±159.7	5884.3	**<0.001**	20.3±9.1	6156.3	**0.007**
2.	**Non-epidural**	271.2±131.3			23.5±9.7		

Table 1: Mean duration of 1st and 2nd stage of labor in two study groups

S. No	Maternal obstetric complications	Epidural		Non-epidural	
		n	%	n	%
1.	**No complications**	236	86.1	266	88.7
2.	**T3 tear**	8	2.9	4	1.3
3.	**T2 tear**	8	2.9	20	6.7
4.	**Lateral wall laceration**	6	2.2	0	0
5.	**MROP**	4	1.5	4	1.3
6.	**Atonic PPH**	12	4.4	6	2
7.	**Total**	274	100	300	100

Table 2: Maternal obstetric complications in two groups of study subjects

S. No	APGAR scores at 5 minutes	Epidural		Non-epidural	
		n	%	n	%
1.	<7	0	0	0	0
2.	7	0	0	2	0.7
3.	8	4	1.5	2	0.7
4.	9	270	98.5	296	98.7
5.	Total	274	100	300	100

Table 3: APGAR scores at 5 minutes distribution in two groups of study subjects

S. No	Groups	Number (n)	APGAR (mean ± S. D)	Mann Whitney U test	p-value
1.	Epidural	274	8.97±0.14	10195.3	0.916
2.	Non-epidural	300	8.96±0.185		

Table 4: Comparison of mean APGAR scores in two study groups

S. No	Birth weight	Epidural		Non-epidural	
		n	%	n	%
1.	<2.5	30	10.9	20	6.7
2.	2.5-3.5	228	83.2	254	84.7
3.	>3.5	16	5.8	26	8.7
4.	Total	274	100	300	100

Table 5: Birth weight distribution in neonates from the study

S. No	NICU admission	Epidural		Non-epidural	
		n	%	n	%
1.	No	130	47.4	144	48
2.	Yes	144	52.6	156	52
3.	Total	274	100	300	100

Table 6: NICU admission needs in two study groups