



Comparative evaluation of epidural ropivacaine (0.1%) and (0.2%) with fentanyl (2mcg/ml) in Labour analgesia

Dr Roopesh Kumar

Associate Professor and Head

Dr Chavi Sethi

Assistant Professor - Corresponding author

Dr Preeti Dahiya

Junior resident.

KEYWORDS :

“Delivery of the infant into the arms of conscious and pain-free mother is one of the most exciting and rewarding moments in medicine “Labour pain is one of the most distressing pain parturient has to bear.. Pain relief in labour has always been surrounded with myths and controversies. Hence providing effective and safe analgesia during labour has remained an ongoing challenge to anaesthesiologist .Both pharmacologic and non-pharmacologic strategies have been used for treatment of labour pains.

The pain of labour results in a maternal stress response, which is neither beneficial for the fetus nor for the mother. Evidence is suggestive that labour disorders including maternal hypertension, dystocia, meconium staining, and fetal distress are all stress related. Hence, maternal pain relief not only benefit the parturient, but her neonate also.

Controversies remain in obstetrical anaesthesia including the effects of regional anaesthesia on the progress and outcome of labour as well as its effects on the neonate. Of all the available methods of labour analgesia, epidural analgesia satisfies the basic requirements of labour analgesia by fulfilling the objective of decreasing the pain of labour without affecting other sensations such as a desire to push and to allow normal walking while preserving the tone of pelvic floor muscles as well as retaining the sensation of the baby's head in the vagina; thus, allowing labour to proceed unhindered. The international Association for the Study of Pain (IASP) declared 2007-2008 as the “Global Year against Pain in Women – Real Women, Real Pain”. The aim was to study both acute and chronic pain in women.

Ropivacaine is a long-acting amide local anaesthetic agent and first produced as a pure enantiomer. It produces effects similar to other local anaesthetics via reversible inhibition of sodium ion influx in nerve fibres. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor blockade. Thus, ropivacaine has a greater degree of motor sensory differentiation, which could be useful when motor blockade is undesirable. The reduced lipophilicity is also associated with decreased potential for central nervous system toxicity and cardiotoxicity. The drug displays linear and dose proportional pharmacokinetics (up to 80 mg administered intravenously). It is metabolised extensively in the liver and excreted in urine.

Aims of the study-

The aims and objectives of this study are :-

To compare the efficacy of two different doses of epidural Ropivacaine (0.1% & 0.2% with fentanyl 2mcg/ml) among parturients. To compare the quality of analgesia in both the groups.

To compare the effects of Ropivacaine on duration & outcome of labour.

To compare the effects on hemodynamics (Pulse rate, NIBP, SpO₂, Mean arterial pressure,) in both the groups.

To compare the Sensory & motor block characteristics.

To compare the neonatal outcome (Apgar score at 1 & 5 minutes)
Any other complications encountered.

Materials and methods

The present study was conducted in Department of Anaesthesiology , MLB Medical College, Jhansi U.P. in parturients who opted for labour analgesia in collaboration with the Department of Obstetrics & Gynaecology.

PATIENTS SELECTION

Following approval from the Ethical committee, ASA I and II parturient having uncomplicated pregnancy with a vertex presentation in active labour, having contraction at least once every 5 min, and who had requested for labour analgesia were enrolled.

After informed consent parturients were subjected to a through pre-anaesthetic evaluation. Before placement of the epidural catheter, VAS score were noted with VAS 0 = no pain and 10 = the worst imaginable pain along with baseline vitals.

EXCLUSION CRITERIA

- Parturients with severe coagulation disorders.
- Severe haemodynamic instability.
- Liver disease and kidney diseases.
- Neurologic disorders or deficit.
- Skin lesions at the site of the blockade.
- Any other comorbid condition

SAMPLE SIZE AND ALLOCATION

Study patients were randomly assigned to one of the following two groups.

- Group R1- received initial epidural injection of 15 ml of ropivacaine 0.1% with fentanyl 2g/ml
- Group R2- received initial epidural injection of 15 ml of ropivacaine 0.2% with fentanyl 2g/ml

LABOUR ANALGESIA TECHNIQUE

Demographic data age, weight, height, obstetric data parity, dilatation of the cervix [0-10cm], station of the vertex of the presenting part [-3 to +3], effacement of the cervix %, membrane status were noted, prior to the initiation of labour analgesia.

After starting a 500 ml infusion of Ringer's lactate in an 18G peripheral intravenous cannula, parturients in both groups were placed in the left lateral position. Following strict aseptic techniques, and infiltrating 2% lignocaine HCl into the intervertebral space, epidural space was identified at L₃₋₄ or L₄₋₅ space using a loss of resistance technique to normal saline with an 18G Tuohy needle. 20 Gauge multi-orifice catheter was threaded through the cephalad directed tip of the epidural needle to a depth of 5 cm into the epidural space. If there was no blood or cerebrospinal fluid (CSF) on aspiration from the epidural catheter, a 3-ml test dose of the study medication was administered through the catheter.

The presence of clinical signs of an intravascular injection were sought, for the following 2-3 mins, by asking the patient whether she felt dizzy, had tinnitus, or a metallic taste in her mouth. If there were no signs of an intravascular injection, the catheter was secured and the patients/parturient were placed in the supine position with left uterine displacement.

Five minutes after the test dose, if there were no clinical signs of subarachnoid injection (as evidenced by the patient's ability to move her legs and the absence of hypotension), an additional 12 ml of the study solution was administered.

Analgesia was considered adequate if pain score was <3. Onset of analgesia was defined as interval between time of first bolus dose to time of achieving VAS <3. If analgesia was not adequate 15 mins after the first initial dose, an additional 15ml of study medication (**second initial dose**) was administered, and analgesia reassessed in the same manner. If pain relief was inadequate at the peak of a contraction, 15 mins after the second initial dose of ropivacaine; the epidural anesthetic was classified as **ropivacaine failure**, and **patient withdrawn from the study**. Presence of motor block in the lower extremities was assessed using a Breen modified Bromage scale (BMBS: Grade 1 as complete motor block to Grade 6 as no motor block). VAS and BMBS were assessed every 15 mins. An additional dose of ropivacaine 15 ml was given as a top-up dose on patient request, with a minimum gap of 15 mins between two subsequent top-up doses. Epidural analgesia was continued through the second stage of labor.

Pain score (VAS), sensory and motor block characteristics and vital parameters (pulse, mean arterial pressure, spo2) were recorded at 0 (before epidural), 5, 15 mins and then every 15 mins till 1 hour and then every 30 mins until the delivery. **Sensory block height was assessed by loss of sensation to pin prick** (blunt head of a pin). **Onset of analgesia** was defined as duration from injection of first initial epidural bolus dose to attainment of VAS <3 and **duration of analgesia** of initial bolus dose was defined as time of administration of study drug until the time of demand of top-up for the first time.

At any point of time during the study period hypotension was defined as systolic blood pressure of <90 mmHg and was treated with bolus of 6 mg ephedrine hydrochloride. Bradycardia was defined as heart rate <60 bpm and was treated with bolus doses of 0.4 mg atropine sulfate. The time taken by the parturient to request for **subsequent top-up dose** was recorded. Labour was managed according to our obstetric department's protocols and mode of delivery (normal/instrumental delivery/caesarean delivery) was noted. Fetal heart rate was monitored throughout. Neonatal assessment was performed by assessing the Apgar score at 1 and 5 min.

Quality of maternal expulsive efforts was assessed by an obstetrician as Grade 0 - Failure, 1-Incomplete, 2 - Good, 3 - Excellent. Quality of analgesia was assessed by anaesthesiologist as Grade 0 - Failure, 1 - Incomplete, 2 - Good, 3 - Excellent, 4 - Not possible to evaluate (NPE) if delivered by cesarean section.

Side-effects including nausea, vomiting, hypotension, hypersensitive reaction, shivering, fever, drowsiness, pruritus, respiratory depression, retention of urine, and weakness in limbs were noted.

At the end of delivery, the epidural catheter was removed. If a caesarean section was performed, the catheter was removed 24 hours after delivery.

Observation and result

The cases were selected from parturients in department of obstetrics and gynaecology, MLB Medical College, Jhansi. A total of 80 parturients were included in the study. They included primi as well as multigravida.

Study patients were randomly assigned in the following two groups each containing 40 parturients.

- Group R1- received initial epidural injection of 15 ml of ropivacaine 0.1% with fentanyl 2g/ml
- Group R2- received initial epidural injection of 15 ml of ropivacaine 0.2% with fentanyl 2g/ml

Table-1 : Distribution of patients according to age.

| Age (in yrs) | Group R1 | Group R2 |
|--------------|------------|------------|
| 15-20 | 09 | 09 |
| 21-25 | 16 | 14 |
| 26-30 | 12 | 13 |
| 31-35 | 3 | 4 |
| Mean±SD | 24.56±4.28 | 24.52±4.43 |

Table 1 shows age distribution of the patients. Majority of patients belonged to 21-25 years of age group in both the groups. There was no significant difference in mean age of patients between the two groups (p>0.05).

Table-2: Demographic & Obstetric Data

| Variable | Group R1(n=40) Mean±S.D | Group R2(n=40) Mean±S.D | p-value |
|-----------------------------------|----------------------------|----------------------------|---------|
| BMI(kg/m2) | 22.35±2.24 | 23.58±3.39 | 0.42 |
| Parity Primiparous Multiparous | 22 18 | 23 17 | 0.05 |
| Period of gestation(in weeks) | 38.33±0.55 | 38.26±0.60 | 0.10 |
| Cervical dilatation | 3.23±0.52 | 3.53±0.66 | 0.31 |
| Duration of labour (minutes) | 210.63 | 200.34 | 0.62 |

Table-2 shows comparison of demographic and obstetric data. Data was comparable among both groups and no statistically significant difference was seen (p>0.05).

Table-3: Mean Arterial Pressure at Different Time Intervals.

| Time (min) | Group R-1 (Mean+S.D) (mmHg) | Group R-2 (Mean+S.D) (mmHg) | p-value |
|------------|-----------------------------|-----------------------------|---------|
| Basal | 87.86±6.10 | 87.40±5.73 | 0.087 |
| 5 | 89.20±5.97 | 88.4±5.58 | 0.08 |
| 10 | 87.20±4.71 | 86.66±4.43 | 0.07 |
| 15 | 88.33±4.30 | 87.53±4.02 | 0.09 |
| 20 | 86.46±3.73 | 86.2±3.49 | 0.08 |
| 30 | 87.40±7.24 | 86.53±6.74 | 0.98 |
| 60 | 87.33±5.39 | 86.66±5.12 | 0.08 |
| 90 | 88.6±5.04 | 87.6±5.18 | 0.07 |
| 120 | 89.8±6.14 | 90.86±5.60 | 0.13 |
| 150 | 86.25±3.71 | 88.56±6.25 | 0.12 |
| 180 | 87.32±5.30 | 88.20±3.71 | 0.10 |
| 210 | 87.46±4.73 | 87.43±5.28 | 0.15 |
| 240 | 88.30±6.24 | 88.56±2.89 | 0.08 |
| 270 | 86.33±5.58 | 87.50±4.24 | 0.09 |
| 300 | 88.65±4.08 | 86.33±4.39 | 0.10 |

Table-3 Showing changes in MAP at different time intervals in both groups. We can see that there were no significant changes in MAP at different time intervals in both study groups. Both the groups were comparable and showed no significant statistical difference. (p > 0.05).

Table-4: Mean Pulse Rate at different time intervals.

| Time (min) | Group R-1 (Mean+S.D) (ppm) | Group R-2 (Mean+S.D) (ppm) | p-value |
|------------|----------------------------|----------------------------|---------|
| Basal | 92.2±5.61 | 92.26±5.61 | 0.07 |
| 5 | 92.33±5.01 | 90.48±5.01 | 0.14 |
| 10 | 90.66±5.45 | 88.77±5.45 | 0.14 |
| 15 | 88.46±5.02 | 88.57±5.01 | 0.07 |
| 20 | 87.60±4.77 | 86.77±4.73 | 0.09 |
| 30 | 87.35±4.42 | 86.60±4.39 | 0.11 |
| 60 | 88.28±4.64 | 87.44±4.62 | 0.18 |
| 90 | 87.04±4.78 | 88.26±4.76 | 0.08 |
| 120 | 91.5±4.45 | 90.88±4.42 | 0.05 |
| 150 | 88.38±6.01 | 88.56±6.02 | 0.06 |
| 180 | 87.57±4.45 | 87.45±5.42 | 0.13 |
| 210 | 88.37±6.04 | 87.29±3.64 | 0.27 |
| 240 | 87.77±5.73 | 86.04±4.75 | 0.33 |
| 270 | 87.60±5.39 | 87.55±6.45 | 0.17 |
| 300 | 88.57±5.45 | 87.58±5.01 | 0.09 |

Table -4 Showing changes in mean pulse rate at different time intervals in both groups. We can see that there were no significant changes in mean pulse rate at different time intervals in both study groups (p > 0.05). Both the groups were comparable and showed no significant statistical difference. (p > 0.05).

Table-6: Onset of analgesia (time to reach VAS 3).

| Time of onset (minutes) | Group R-1 (%) | Group R-2 (%) | p-value |
|-------------------------|---------------|---------------|---------|
|-------------------------|---------------|---------------|---------|

| | | | |
|-------|---------|--------|--------|
| 0-5 | 7(17.5) | 26(65) | <0.001 |
| 5-15 | 28(70) | 14(35) | <0.001 |
| 15-30 | 5(12.5) | 0 | <0.001 |

Table-6 shows onset of analgesia in both groups. onset of analgesia was found to be significantly faster in group R-2. (65% parturient in 0-5min) as compared to group R1 (17.57 parturient in 0-5 min).This difference was found to be highly significant with p-value<0.001.

Table-7: Different Modes of Delivery

| Mode of delivery | Group R-1 (%) | Group R-2 (%) | p-value |
|---------------------|---------------|---------------|---------|
| Spontaneous vaginal | 32/40(80) | 29/40(72.5) | 0.73 |
| Forceps | 5/40(12.5) | 7/40(17.5) | 0.65 |
| LSCS | 3/40(7.5) | 4/40(10) | 0.45 |

Table-7 shows mode of delivery in both groups. Majority of the parturients had normal spontaneous vaginal delivery in both groups with no statistically significant difference.

Table-8: Neonatal Apgar Score

| Apgar Score | Group-R1 | | Group- R2 | | p-value |
|--------------------|----------|-------|-----------|-------|---------|
| | 1 min | 5 min | 1 min | 5 min | |
| < 6 | - | - | - | - | |
| 6 | 2 | - | 2 | - | |
| 7 | 7 | - | 5 | - | |
| 8 | 22 | 1 | 24 | 1 | |
| 9 | 6 | 5 | 5 | 6 | |
| 10 | 0 | 31 | 0 | 29 | |
| 1 (min) (Mean+S.D) | 7.8±0.26 | | 8.0±0.33 | | 0.06 |
| 5(min) (Mean+S.D) | 9.8±0.22 | | 9.78±0.20 | | 0.67 |

Table -8 shows neonatal Apgar scores at 1 and 5 mins .Data was found to be comparable in both groups at 1 and 5 mins intervals with .p-value >0.05.

Table-10: Bolus and Number of top up dose requirement till delivery.

| Doses Required (ml) | Group R-1 (%) | Group R-2 (%) | p-value |
|---------------------|---------------|---------------|---------|
| Bolus dose alone | 14(35) | 36(90) | <0.001 |
| 1 top-up | 19(47.5) | 4(10) | <0.001 |
| 2 top-up | 7(17.5) | - | - |
| Mean top-up doses | 0.9±0.75 | 0.03±0.32 | <0.001 |

Table 10 shows Bolus and number of top up dose requirement till delivery. Majority of parturients in group R2 (90%), didn't required any further epidural top-up doses following bolus dose. On the contrary, majority of the parturients in group R1 (47.5%) required at least one epidural top-up dose and these differences were found to be highly statistically significant with p<0.001.

Table-11: Duration of Analgesia

| Duration of analgesia (min0) | Group R-1 (Mean+S.D) | Group R-2 (Mean+S.D) | p-value | t-test |
|--|----------------------|----------------------|---------|--------|
| Bolus dose | 68.34±35.16 (n = 14) | 128.03±50.41 (n =36) | <0.001 | 6.14 |
| Mean time interval between Bolus to first top -up(n =19) | 57.26±18.23 (n =19) | 127.04±52.23 (n =4) | <0.001 | 5.35 |
| First -second top-up | 68±38.50 (n=7) | - | - | - |

Table -11 shows mean duration of analgesia in both the groups. Duration of analgesia after initial bolus dose was found to be significant longer in R2 than in group R1(68.34±35.16 minutes in group R-1& 128.03±50.41 minutes in group R-2) with highly significant p-value<0.001.

Table-12: Consumption of local anaesthetic and opioid.

| Total dose required | Group R-1 (Mean+S.D) | Group R-2 (Mean+S.D) | p-value | t-test |
|---------------------|----------------------|----------------------|---------|--------|
| Ropivacaine (mg) | 32.28±11.36 | 30.32±10.26 | 0.42 | 0.80 |
| Fentanyl(µg) | 53.0±17.26 | 30.32±10.26 | <0.001 | 7.17 |

Table-12 shows total mean consumption of local anaesthetic and opioid in both groups. Consumption of Ropivacaine was comparable in both

groups with no statistically significant differences. On the contrary consumption of Fentanyl was significantly more in Group R1 when compared to Group R2 with highly significant p value-<0.001.

Table-13: Maternal Satisfaction.

| Maternal satisfaction | Group R-1 (%) N=40 | Group R-2 (%) N=40 | p-value |
|-----------------------|--------------------|--------------------|---------|
| Excellent | 26/40(65) | 28/40(70) | 0.633 |
| Satisfactory | 14/40(35) | 12/40(30) | 0.619 |
| Poor | 0 | 0 | - |

Table-13 shows maternal satisfaction among both groups. Majority of the parturients had excellent satisfaction in both study groups. None of the parturients had poor satisfaction in either group. Data was comparable in both groups with no statistically significant difference with p-value>0.05.

Discussion

The demographic data i.e. Age, Weight, Height was comparable in both group. Mean age was 24.56±4.25. in group R1 while it was 24.52±4.43 in groups R2 .Mean BMI of parturient was 22.35±2.24. kg/m2 in Group R1 while it was 23.58±3.39kg/m2 in group R2 (table-2) and was statistically insignificant.

In the present study Analgesia was considered adequate if pain score (VAS) becomes < 3. Onset of analgesia was defined as time interval between first bolus dose to achieving VAS <3. Onset of Analgesia was significantly faster in group R2 (65% parturient in 0-5 min) as compared to groups R1 (17.5% parturient in 0-5 min) with p-value<0.001.

Onset of Analgesia in the present study is in accordance with that of Chhetty *et al.*, 2013. In this prospective study minimum effective concentration of local Anesthetics for providing optimal Labour epidural analgesia and the strategies aiming to reduce their consumption were evaluated. Minimum effective concentration of local anaesthetic was found to be 0.125% and onset of analgesia was found to be significantly faster with 0.2% ropivacaine.

Similar result were also obtained in M-Dresner *et al.*, 2000 who performed a randomized double-blind comparison of two epidural drug regimens for labour analgesia. The study entitled Ropivacaine 0.2% versus bupivacaine 0.1% with fentanyl a double blind comparison for analgesia during labour. In this study also it was concluded that 0.2% ropivacaine produces better first stage analgesia and had significantly faster onset of analgesia. In the present study no significant derangements were observed in Hemodynamic parameters in either of the group. Both the groups were found to be comparable, statistically insignificant as seen in previously published studies.

Duration of analgesia after initial bolus dose was found to be significantly longer in group R2 (128.03 ± 50.41) than in group R1 (68.34±35.16), with highly significant p value <0.001. These findings were in concordance with the results of previously published studies.

Outcomes of labour in terms of Mode of delivery (SVD, Caesarean Section Instrumental Delivery) were comparable in both the study groups with no statistically significantly difference. Previously published studies, Dresner *et al.*, (2000) in which two study groups (Ropivacaine 0.2% versus bupivacaine 0.1% with fentanyl) were evaluated for complete analgesia at 30 min, delivery mode, visual analgesia scores (VAS) for first and second stage of labour ,had similar results .

Consumption of local anaesthetic (Ropivacaine 0.2% and 0.1%) was comparable in both groups with no statistically significant difference. On the contrary opioid consumption (fentanyl) was significantly more in group R1 (53.0 ± 17.26) as compared to group R2 (30.32 ± 10.26) with p- value < 0.001 due to requirement of frequent top-up doses in group R1. This inference drawn was in concordance with the previously published studies.

In our study the effect of epidural analgesia in both groups showed that no parturients in our study had weak expulsive efforts that may lead to increase in incidence of assisted/caesarean deliveries. In group R1 77.5% of parturients had excellent efforts and 22.5% had good efforts. In groups R2 75% of the parturients had excellent efforts and 25% had good efforts. None had incomplete or failed expulsive efforts as

assessed by obstetrician. None of the parturients had poor satisfaction in either group. Majority of them had excellent satisfaction in both study groups and no statistically significant difference was seen among two groups.

Arun Ahirwar *et al.*, (2014) conducted a study entitled Patient controlled epidural labour analgesia (PCEA) : A comparison between Ropivacaine; Ropivacaine-fentanyl and Ropivacaine-Clonidine Ninety primigravida in labour were divided into three groups (n=30) and patients controlled epidural labour analgesia was given to them. Initial bolus of 10 ml of Ropivacaine 0.125% in group I, with fentanyl 2g/ml/ml in group II and with clonidine 1g/kg in group III. The maternal satisfaction in all three groups was comparable and most of the parturients were extremely satisfied and none of the parturient in either group was found to have weak expulsive efforts.

Neonatal Apgar score at 1 and 5 min, in both the study groups revealed no appreciable difference in Apgar Score (p value > 0.05).

Result & conclusion

- Demographically (i.e age, height, weight) both groups were comparable.
- Pulse rate changes in both the groups were comparable and found to be insignificant.
- Mean arterial pressure changes in both the groups were comparable and found to be insignificant.
- Effective labour analgesia without motor blockade was observed in both the groups.
- Onset of Analgesia was significantly faster in group R2 (65% parturients in 0-5 min) as compared to group R1 (17.5% parturients in 0-5 min), with highly significant p-value < 0.001
- Duration of analgesia after initial bolus dose was also significantly longer in group R2 (128.03±50.41) than in group R1 (68.34±35.16), with highly significant p-value < 0.001.
- Requirement of top-up doses was significantly less in group R2 (0.03±0.32) as compared to group R1 (0.9±0.75), with highly significant p-value < 0.001
- Consumption of fentanyl was also significantly more in group R1(53.0±17.26) as compared to group R2 (30.32±10.26), with highly significant p-value < 0.001
- Neonatal Apgar score at 1 and 5 min, in both the study groups revealed no appreciable difference in Apgar Score (p value > 0.05).
- Majority of the parturients had excellent expulsive efforts as well as satisfaction in both the groups and it was comparable .
- No adverse effects related to neonatal or maternal outcomes were encountered in both the groups.
- None of the parturients had any side-effects like nausea, vomiting, pruritis or hypotension as concentration and total dose of Ropivacaine and Fentanyl administered was very low
- Rather most of the Parturients experienced relief in their symptoms of nausea and vomiting as their labour pains subsided by the administration of labour analgesia.

CONCLUSION

Both the concentrations of ropivacaine (0.1% and 0.2%) with fentanyl are quite effective in producing epidural labour analgesia but 0.2% concentration was found superior in terms of faster onset, prolonged duration, lesser top-ups and lesser consumption of opioids without any maternal or foetal adverse consequences.

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