To Compare the Effects of Intermittent versus Continuous Administration of Epidural Ropivacaine with Fentanyl for Labour Analgesia at Govt. T.D. Medical College, Alappuzha

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ABSTRACT

BACKGROUND

Labour analgesia improving the maternal and neonatal outcome is time proven. Primary objective was to compare the quality of analgesia using visual analogue scale and secondary objectives were to assess the progress of labour, incidence of instrument assisted delivery, total dose of drug used in each technique, neonatal outcome and the incidence of maternal side effects.

METHODS

A prospective interventional study was done in 40 willing Primigravida (20 in each group) with uncomplicated singleton term gestation admitted to labour room during the period of 1 year after obtaining ethical clearance. Sample size calculated was 25 using the formula $4pq/d^2$ with 80 % power. Statistical analysis was done by SPSS v16 software. Association was tested using chi square test for qualitative variables and quantitative variables was tested using independent sample t test. Statistical significance between the VAS scores was tested using Mann Whitney test.

RESULTS

Demographic variables, pain scores, motor block and neonatal outcome were comparable in both the groups. The total drug requirement (p-0.5) and duration of second stage (p-0.08) were less and incidence of hypotension (p - 0.29) and rescue dose requirement (p-0.6) was more in intermittent bolus group. Instrumental delivery was higher in continuous infusion group. All parturients developed urinary retention.

CONCLUSIONS

Low volume of 0.2% ropivacaine with 2 mcg/mL fentanyl was effective in alleviating labour pain. Both techniques were equally effective and can be recommended for labour analgesia.

KEY WORDS

Labour Analgesia, Epidural, Intermittent Bolus, Continuous Infusion, Ropivacaine 0.2%

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BACKGROUND

Labour pain is one of the most painful experiences for women. Labour analgesia is being extensively practiced in obstetrics worldwide nowadays as labour pain adds to significant maternal stress and epinephrine released has effects on progression of labour and foetal heart rate.(1) Few significant effects of labour pain include increased maternal cardiac output, peripheral vascular resistance and decrease in uteroplacental perfusion. Transient episodes of maternal and foetal hypoxemia occur due to intermittent hyperventilation hypoventilation cycle during labour in the absence of supplemental oxygen administration.(2) It is necessary that feasible analgesia is used to improve maternal satisfaction and decrease the side effect of mother and foetus. Neuraxial labour analgesia among which epidural labour analgesia is the commonly used technique for labour analgesia now a days. Lumbar epidural analgesia is one of the common modalities of neuraxial labour analgesia. Several improvements in epidural analgesia occurred in late nineteens. Drugs can be administrated either as intermittent boluses or continuously with infusion pumps. Infusion pumps now available are more compact, reliable and patient friendly. Continuous infusion techniques enhanced patient safety and satisfaction. Epidural analgesia reduces neonatal exposure to systemic opioids and sedatives as well as improves placental perfusion and oxygenation of the foetus which is beneficial especially in conditions such as pregnancy-induced hypertension. Regional blocks are also administered for the majority of caesarean deliveries because of the better evidence of maternal and foetal safety compared with general anaesthesia. Traditional epidural analgesia was initiated with 0.25% to 0.5% bupivacaine and maintained with intermittent bolus doses of bupivacaine. But parturients developed dense motor block with this drug concentration.

Ideal local anaesthetic for labour analgesia should produce reliable sensory block, no motor block, without tachyphylaxis, should have a good safety profile. Administration of amide local anaesthetic in combination with opioid is routinely used for relief of labour pain. Lipid soluble synthetic opioid fentanyl can increase the potency of amide local anaesthetics. Bupivacaine is found to dissociate more slowly from the inactive and resting sodium channel configurations for which it has a greater affinity. This renders cardiac tissues susceptible to arrhythmias since recovery from action potentials is delayed. Ropivacaine is less lipophilic than bupivacaine. It is less cardiotoxic than bupivacaine, it has a selective action on the sensory fibers (A δ and C) as it is less likely to penetrate large myelinated (A α) motor fibers. Our study is a comparison of the effects of intermittent versus continuous administration of epidural Ropivacaine 0.2% with Fentanyl 2 mcg/mL for labour analgesia. Not much Indian studies have come in the field of labour analgesia with this drug formulation and comparing the two techniques of epidural drug administration.

METHODS

A prospective interventional study was conducted in parturients who were admitted to labour room of Government T D Medical College Hospital, Alappuzha during the period of 1 year after obtaining ethical clearance. Sample size was calculated using the formula $4pq/d^2$. p - proportion of parturients with good analgesia, q - 100 - p, d - allowable error (20% of p). Sample size obtained was 25 with 80% power (Fettes PDW, Moore CS, Whiteside JB, McLeod GA, Wildsmith J a. W. Intermittent vs continuous administration of epidural ropivacaine with fentanyl for analgesia during labour). Parturients who consented for labour analgesia and who received either continuous or intermittent administration of formulated drug were observed and were included into 2 groups-

- Group I- epidural intermittent top up group.
- Group C- epidural continuous infusion group.

Inclusion Criteria

- Primigravida who consented to receive labour analgesia American Society of Anaesthesiologists (ASA) physical status 2.
- Uncomplicated vertex presentation.
- Singleton gestation.
- Gestational age more than 36 weeks.

We excluded parturients with age less than 21 yrs. and more than 40 yrs, height less than 145 cm and more than 170 cm, weight more than 90 kg, parturient who received parenteral opioids within previous 4 hours, more than 5 cm cervical dilatation

Study Procedure

After getting clearance from the institutional research and ethics committees, parturients were selected as per the inclusion and exclusion criteria. Detailed preanesthetic evaluation was done. After obtaining an informed written consent, peripheral intravenous access was obtained with 18-gauge cannula. 500 ml of injection Ringer lactate was preloaded over a period of 20 mins. Maternal pulse rate, blood pressure, electrocardiogram, oxygen saturation by pulse-oximeter and respiration were noted. Fetal heart rate and degree of uterine contractions were monitored using cardiotocograph.

Parturients were positioned in lateral decubitus position for initiation of neuraxial analgesia at 3cm cervical dilatation. The epidural space was identified using the loss of resistance to the injection of air technique, with an 18-gauge Touhy needle inserted at the third and fourth lumbar vertebral interspace via midline approach. With the bevel directed cephalad, a three-side hole epidural catheter was advanced 4 cms into the epidural space. A 3 ml test dose of 1.5% lignocaine with adrenaline 15 mcg was injected after negative aspiration to rule out intrathecal or intravascular placement.

Epidural catheter was then secured in place. Parturient was then positioned supine and wedge was placed under right buttock to prevent aortocaval compression. An initial bolus dose of 5 ml of 0.2% ropivacaine was injected. Increment of 3 ml of injection ropivacaine (0.2%) was given every 5 mins till a sensory level of T_{10} was achieved. Assessment of the sensory level of block was done by absence of pin prick sensation with a short bevelled 27-gauge hypodermic needle every 5 min. If sensory block was not achieved bilaterally at the T_{10} level after 20 mins, and if the parturient was still in pain, an additional 3 ml dose of

injection ropivacaine was administered. If at 30 mins a bilateral sensory block to T_{10} was not produced despite this additional bolus, the parturient was withdrawn from the study and systemic analgesia was given. The time at which the T_{10} level was achieved (and the parturient was pain free) was defined as time zero.

Thereafter parturient received either hourly intermittent boluses of 5 ml to 6 ml injection ropivacaine 0.2% with fentanyl 2 mcg/mL or a continuous infusion of same formulated drug at the rate of 5 ml to 6 ml/h using an infusion pump. Parturients were permitted to change their position between lateral position or supine position with a wedge under the buttock. Sensory block was assessed bilaterally in the midclavicular line. After achieving T_{10} level, labour pain was assessed using VAS at 30 min interval. VAS has marks from 0-100, 0 means no pain and 100 mean worst pains possible. If (and only if) pain relief was requested by the parturient in between, sensory level was checked and additional 3 to 5 ml of the study mixture was given (maximum number rescue doses 2, minimum interval between doses 15 min).Routine assessment of levels of sensory and motor block, maternal heart rate, blood pressure and respiration was done at the same time as pain assessment every half hourly till delivery or a maximum of 300 minutes. Motor block was assessed with Bromage score (0=full flexion of knees and feet; 1=just able to move knees; 2=able to move feet only; 3=unable to move feet or knees).

Fetal heart rate and degree of uterine contraction were monitored continuously by cardiotocograph. Parturient was motivated to bear down during active contractions once cervix was fully dilated (10 cm). Mode of delivery whether normal vaginal, instrumental or caesarean section was noted. Pain during episiotomy incision was controlled with epidural drug administration. Maternal side effects like pruritis, urinary retention, nausea, vomiting, shivering, maternal pyrexia and seizure were observed for in both groups. Hypotension (defined as 30% decrease in initial systolic blood pressure or a systolic BP less than 100 mm Hg) was treated with ringer lactate/ normal saline and/or intra venous boluses of ephedrine 3 mg. Neonatal outcome were observed by the following variables like APGAR score at 1 minute and 5 minutes and incidence of NICU admission. Total requirement of drug for each parturient was also noted. Post-partum evaluation for complete placental removal, contracted uterus and traumatic post-partum haemorrhage was also done.

Statistical Analysis

The present study was done using 40 subjects 20 in each group. All data were entered into Microsoft excel sheet and statistical analysis was done by SPSS Ver. 16 software. Qualitative variables were expressed in percentages and quantitative variables were summarized in mean with standard deviation for normally distributed data and median and inter quartile range for skewed data. Statistical significance of association between outcome variables and exposure variables was tested using Pearson chi square test for qualitative variables and the strength of association was expressed using odds ratio. Statistical significance between quantitative variables was tested using independent sample t test. Statistical significance between the VAS scores in the 2 groups was tested using Mann Whitney test. P value of less than 0.05 was considered to be statistically significant.

RESULTS

Parturients were selected as per inclusion and exclusion criteria and none of the parturient was excluded from the enrolled. Both groups were comparable in view of their age, height, weight and gestational age (table 1). Epidural administration of drug combination started at 3 cm dilatation in parturients in both the groups. There was no statistically significant difference in duration for attainment of time zero in group C (10±0) and group I (10.25±1.118) (p value 0.324) (table 2). Good pain relief was noticed, and sensory level was maintained at T10 in both groups and there was no statistically significant difference in VAS score comparing both the groups using Mann Whitney test (table 3). None of the parturients developed motor block (Bromage Score 0) but due to lack of proprioception most of the parturients found it difficult to stand up. No statistically significant difference was noticed comparing maternal heart rate in both the groups and there wasn't any development of maternal bradycardia in both groups.

	Group C Mean (SD) n = 20	Group I Mean (SD) n = 20	p Value
Age (years)	25.2(3.139)	24.9(4.541)	0.809
Height (cm)	157.20(1.542)	158.10(1.553)	0.074
Weight (kg)	60.60(4.248)	59.75 (4.610)	0.548
Gestational age (wks.)	38.41(1.133)	38.41(0.916)	0.988

Table 1. Patient Demographics

Group C – continuous infusion. Group I- intermittent top ups. p value not less than 0.05.Groups are comparable.

Time Zero (mins)	Group C Mean (SD) n = 20	Group I Mean (SD) n = 20	p Value
	10(0)	10.25(1.118)	0.324

Table 2. Attainment of Time Zero

Group C – continuous infusion. Group I- intermittent top ups. p value not less than 0.05. Statistically not significant.

Time (Min)	Group C n=20	Group I n=20	p Value
30	0(0)	0(0)	0.187
60	0(0)	0(20)	0.052
90	0(0)	0(10)	0.130
120	0(2.5)	0(10)	0.170
150	10(12.5)	0(10)	0.667
180	0(10)	10(30)	0.185
210	10(10)	10(20)	0.343
240	10(10)	10(30)	0.838
270	0(0)	0(30)	0.564
300	0(0)	0(10)	0.564

Table 3. VAS Score (Median with IQR)

Group C – continuous infusion. Group I- intermittent top ups. p value not less than 0.05

Time (Min)	Group C mean (SD) n = 20	Group I\Mean (SD) n = 20	p Value
Duration of second stage	46.5(16.788)	37.5(15.770)	0.089

Table 4. Second Stage Duration

Group C – continuous infusion. Group I- intermittent top ups. p value not less than 0.05. Statistically not significant.

There weren't any significant foetal heart rate decelerations in both the groups. Group C was found to have a longer duration of second stage of labour (46.5±16.788 mins) compared to Group I (37.5± 15.770 mins) but the difference was not statistically significant (table 4) and none of the patients had a prolonged second stage of labour. 15% of

parturients in Group C required rescue doses compared to 10% in Group C but again this difference was not statistically significant (figure 1).There was a minimal decrease in mean drug requirement in Group I compared to Group C but this was not statistically significant.

18 parturients (90%) in group I had normal vaginal delivery compared to 17 parturients (85%) in group C. 3 (15%) of them had instrumental delivery in group C and 2(10%) of them had caesarean section in group I. But these were not statistically significant. None of the parturient required local infiltration for episiotomy and they were found comfortable throughout episiotomy suturing and occasionally in 2 parturients for manual removal of placenta when the internal os was open. Neonatal outcome in view of APGAR at 1 min and 5 min and NICU admission were comparable in both the groups.

There was no statistically significant difference in adverse effects in both the groups but shivering and hypotension was found to be higher in Group I compared to Group C. All parturients required catheterization as they lacked the sensation of bladder distension. None of the parturients developed pyrexia, seizures or respiratory depression. Parturients in Group C was found to be comfortably sleeping once pain relief is obtained compared to Group 1 but it was not found to be statistical significant.

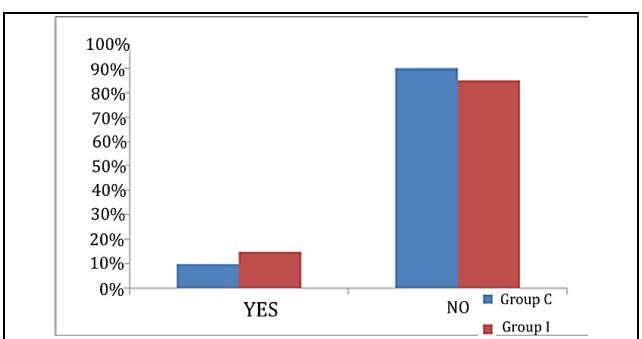

Figure 1. Rescue Dose Requirement

Group C – continuous infusion. Group I- intermittent top ups.

DISCUSSION

In this study we compared effects of intermittent bolus versus continuous infusion of epidural ropivacaine with fentanyl for labour analgesia. Our primary objective was to compare the quality of analgesia and secondary objectives were to assess the progress of labour, incidence of instrument assisted delivery, total dose of drug used in each technique and to study the neonatal outcome as per APGAR score, NICU admission and foetal and maternal adverse effects.

Bupivacaine, levobupivacaine and ropivacaine are commonly used local anaesthetics in labour analgesia.[4] Different additives are added currently like opioids (fentanyl, sufentanil), α 2 agonist (clonidine, dexmedetomidine) etc. In our study we used 0.2% ropivacaine with fentanyl 2 mcg/mLand drug administration was started at 3 cm cervical dilatation. The mean time to attain T_{10} sensory level was 10 mins after start of ropivacaine 0.2% bolus dose in continuous infusion group and 10.25 min in intermittent bolus group though not statistically significant. This finding was in accordance with a study done by Lin et al.[5]

The average volume of ropivacaine to attain T10 sensory level was 8 ml along with 3 ml test dose of 1.5% lignocaine with 1 in 4 lakhs adrenaline. The mean height of parturients in our study population was 157.20 cm in continuous infusion group and was 158.10 cm in intermittent bolus group. In a study by Fettes et al average volume of ropivacaine used to attain T_{10} sensory level was 15 ml where mean height of parturient was 166.1 cm in intermittent bolus group and 163.8 cm in continuous infusion group.[6] Paddalwar et al studied an Indian population with an average height of 154 cm and the initial bolus volume required for them to attain T_{10} sensory level was 10 ml of ropivacaine or bupivacaine 0.125% given in two aliquots after giving a test dose of 3 ml of 2% lignocaine with adrenaline.[7] Reduced dose requirement in our study population may be due to reduced height in Indian mothers.

In our study average dose of ropivacaine (0.2%) for continuous infusion was 45.8 mg and for intermittent bolus was 43.2 mg. The average dose was calculated from dose administered from 3 cm cervical dilatation to delivery of baby. But this difference was statistically insignificant. This can be attributed to the difference in height of the study population and cervical dilatation at the start of epidural infusion. The mean volume of 0.2% ropivacaine used was about 23.85 ml for continuous infusion group and 21.80 ml for intermittent bolus group in our study. A study by Lyons GR et al concluded that increased concentration decreased the volume of local anaesthtics.[8]

Pain score were similar, and it was not statistically significant. In studies conducted by Fettes et al, Joana Nunes et al and a metanalysis by Ronald B George et al no statistically significant difference in the pain scores was observed in their study groups.[8,9,10] Parturients in continuous infusion group was found to have better maternal satisfaction, as assessed by a question and observing. In a study by Joana Nune et al maternal satisfaction was better with continuous infusion group, similar to our study.[9] There was no statistically significant difference in motor blocking our study group. This result was similar to a study by Joana Nune et al, study by Fettes et al and one by Fan et al.[6,9,11] But in a study conducted by Leone Robert Maggiore et al continuous infusion had high incidence of motor block than with intermittent bolus.[12]

Average duration of second stage in intermittent bolus group was shorter compared to continuous infusion group but this was not statistically significant in our study. This observation was comparable to result of a meta-analysis by Ronald B George et al but was statistically significant.[10] Incidence of instrumental delivery was higher in continuous infusion group compared to intermittent bolus group though statistically insignificant. Incidence of instrumental delivery was higher in continuous infusion group in a study by Capognaet al.[13] Neonatal outcome assessed by APGAR score at 1 min and 5 min and NICU admission rate was comparable in both the study groups. Incidence of hypotension was more in intermittent group compared to continuous group these were not statistically significant. There were no statistically significant differences in the incidences of vomiting,

shivering, pruritis in both the groups which was similar to other studies.

CONCLUSIONS

Low volume of 0.2% ropivacaine with fentanyl was effective in alleviating labour pain. Both continuous and intermittent techniques of drug administration were equally effective for pain relief. Time to attain a sensory level of T_{10} and rescue dose requirement was less, and maternal satisfaction was more with continuous infusion than with intermittent epidural bolus. Incidence of hypotension was less with continuous infusion. Total dose requirement was more in continuous group but compared to other studies the overall total dose requirement was less in our study for continuous infusion group. The incidence of caesarean section was nil for continuous infusion group in our study. Duration of second stage and incidence of instrumental delivery was more in continuous infusion group compared to intermittent epidural bolus group. Since all the above parameters were not statistically significant both techniques can be recommended for labour analgesia. A shift from continuous epidural infusion (with or without PCEA) which is routinely used now a days to intermittent epidural bolus (with or without PCEA) will require enhanced pump technology and acceptance by obstetric anaesthesiologists to justify the cost of pump replacement to hospital administration.[10]

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