Original Research Paper

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COMPARATIVE EVALUATION OF 0.125% BUPIVACAINE WITH FENTANYL 2mcg/ml AND 0.25% ROPIVACAINE WITH FENTANYL 2mcg/ml FOR EFFECTIVE EPIDURAL LABOR ANALGESIA: AN OBSERVATIONAL STUDY

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KEYWORDS :

INTRODUCTION

"The delivery of the infant into the arms of a pain-free and conscious mother is one of the most exciting and rewarding moments in medicine" [1].

Labor analgesia plays a critical role in modern obstetric care, providing essential pain relief during childbirth and significantly influencing both maternal and fetal outcomes. Effective management of labor pain enhances maternal comfort and satisfaction and can impact labor progression and delivery methods [7].

In the past, labor pain was managed primarily with systemic analgesics like opioids, which often resulted in inadequate pain relief and were associated with side effects such as sedation and respiratory depression [5]. The development of regional analgesia, notably epidural analgesia, represented a significant advancement by offering targeted pain relief with fewer systemic effects [6]. Epidural analgesia involves administering local anesthetics, such as bupivacaine or ropivacaine, combined with opioids like fentanyl, into the epidural space. This technique effectively blocks pain from the lower body while allowing the mother to stay alert and involved during labor [4].

Effective labor analgesia not only alleviates pain but also improves maternal outcomes by reducing stress, anxiety, and complications related to uncontrolled pain [2]. It enhances the overall childbirth experience, increasing maternal satisfaction and potentially benefiting postpartum recovery and bonding [3].

Historically, labor pain management has encompassed a range of approaches, from non-pharmacological methods like breathing techniques and massage to pharmacological interventions including systemic opioids and regional anesthesia techniques such as epidural analgesia [2]. The introduction of epidural analgesia in the early 20th century revolutionized labor painmanagement by providing superior pain relief while allowing for maternal mobility and consciousness [3].

Despite its advantages, the use of labor analgesia involves various considerations. Factors such as maternal preferences, cultural beliefs, resource availability, and potential side effects affect its use and effectiveness [2].

Therefore, understanding the impact of different analgesic techniques on both maternal and neonatal outcomes is crucial for optimizing clinical practices and ensuring safe and satisfying childbirth experiences.

METHODS:

After obtaining informed consent, 120 eligible parturients were randomly assigned to two groups for epidural analgesia: GROUP B (Bupivacaine) and GROUP R (Ropivacaine).

The procedure was explained to each patient, and all emergency equipment was prepared. Patients were positioned laterally, and an epidural catheter was inserted at the L3-L4 interspace.

After confirming proper placement, the catheter was secured and a test dose of local anesthetic with Fentanyl was administered. Vital signs were monitored closely.

Patients were then transferred to the labor ward, monitored in a supine or lateral position, and encouraged to change positions hourly. Epidural top-ups were given based on pain or discomfort. During the second stage of labor, additional local anesthetic was administered for perineal pain relief, with patients encouraged to push during crowning.

PARAMETERS MONITORED INCLUDED:

1. Oxygen saturation (SpO2)
2. Non-invasive blood pressure (NIBP)
3. Pulse rate (PR)
4. Pain score (VAS)
5. Fetal heart rate (FHR)

Post-delivery, assessments included: 6. Highest level of sensory block 7. Motor blockade (Bromage scale) 8. Total dose of local anesthetic and Fentanyl used 9. Patient satisfaction 10. Mode of delivery

RESULTS:

Both groups were similar in terms of obstetric history, age, demographics, and parity. The comparison of other parameters between the two groups is as follows:

PHYSICAL CHARACTERISTICS:

TABLE 1:

	GROUP B MEAN(SD)	GROUP R MEAN(SD)	
AGE	24.43(3.7)	23.63(3.4)	P value 0.6
HEIGHT	155.1(2.3)	155.2(2.16)	P value 0.8
WEIGHT	64(4.8)	63.93(5.0)	P value 0.93
BMI	25.1(3.5)	25.8(1.9)	P value 0.17

We compared Group B and Group R across age, height, weight, and BMI to identify any significant differences. All p-values were above 0.05, suggesting no significant differences between the groups.

TABLE 2:

	GROUP B	GROUP R	T VALUE	P VALUE
ONSET OF ANALGESIA	19.75(1.7)	17.5(2.42)	5.89	0.0001
TOTAL NO. OF TOPUPS	2.3(0.7)	1.8(0.3)	5.08	0.0001
TOTAL DOSE OF LOCAL ANESTHETIC(ml)	42.08(8.9)	70.83(9.3)	17.3	0.0001
TIME BETWEEN TOPUPS(min)	87.5(5.7)	98.67(702)	9.4	0.0001

Table 2 indicates that the onset of analgesia was quicker in Group R. Group R also required fewer top-ups compared to Group B. Conversely, Group B needed a lower total dose of local anesthetic and had shorter intervals between top- ups.

Overall, Group R (ropivacaine) delivered faster pain relief and needed fewer top-ups but required a higher total dose of local anesthetic. In contrast, Group B (bupivacaine) had a slower onset of analgesia, required more top-ups, and used a lower total volume of anesthetic, with shorter time intervals between top-ups.

Comparing the two groups (Group B and Group R) at various time intervals reveals no statistically significant differences. The p-values are consistently greater than 0.05, and the t-values are relatively low, indicating that the differences in means between the groups are minimal and not statistically significant.

DISCUSSION:

Various methods are available for providing pain relief to laboring women, with epidural analgesia being the gold standard among regional techniques. It is theonly method capable of delivering comprehensive and effective pain relief, potentially making labor a more positive experience.

In our study, we compared two approaches to epidural analgesia: intermittent bolus top-ups with 0.125% bupivacaine combined with fentanyl 2 mcg/ml (Group B) and 0.25% ropivacaine combined with fentanyl 2 mcg/ml (Group R).

We evaluated these techniques based on their analgesic efficacy as well as their effects on maternal and fetal outcomes, and overall labor progression.

Chhetty et al. [8] reported that 0.2% ropivacaine with 2 µg/mL fentanyl was more effective than 0.125% ropivacaine. In contrast, Harms et al. [9] found 0.125% bupivacaine to be the optimal concentration for epidural analgesia during labor. Additionally, Patkar et al. [10] preferred the intermittent bolus technique, noting it led to reduced total drug consumption and lower incidence of breakthrough pain, thus offering a more effective mode of drug delivery.

Accordingly, in our study, we compared 0.25% ropivacaine with 2 µg/mL fentanyl to 0.125% bupivacaine with 2 µg/mL fentanyl, administered as 10 mL boluses when the Visual Analog Scale (VAS) score reached ≥3.

The impact of epidural analgesia on labor progression and outcomes has been debated. Concerns have been raised that motor blockade from epidural local anesthetics might impair patient mobility, reduce maternal effort, and lead to inadequate fetal head rotation, potentially resulting in increased rates of instrumental delivery and cesarean sections. However, in our study, we did not observe motor blockade, as the concentrations of local anesthetics used were minimal. Contrary to the belief that epidural analgesia prolongs labor, we found no statistically significant difference in labor duration between the groups. This finding was also noted by our obstetrician. We attribute this to the analgesia's beneficial effects, which include mitigating sympathetic responses, enhancing uterine contraction coordination, and improving uterine blood flow.

Halpern and Walsh [12] found no significant differences in neonatal outcomes between ropivacaine and bupivacaine used for labor epidural analgesia. In our study, fetal heart rates remained within normal limits, and there were no cases of post-epidural fetal bradycardia.Regarding the onset of analgesia, ropivacaine had a mean onset time of 17.5 minutes compared to 19.75 minutes for bupivacaine, with a statistically significant p-value of 0.0001.

Lee et al. [11] noted that bupivacaine could prolong the first stage of labor, potentially due to higher concentrations that induce motor block and extend labor. However, our results align with other studies using lower concentrations (0.075%–0.125%), which found no significant differences in the durations of the first or second stages of labor. Specifically, the total labor duration was 252.2 minutes for the bupivacaine group and 232.6 minutes for the ropivacaine group, but this difference was not statistically significant ($p = 0.3$).

Additionally, the time between top-ups was shorter in the bupivacaine group (87.5 minutes) compared to the ropivacaine group (98.67 minutes), with a significant p-value of 0.0001. The total dose required was also lower for bupivacaine (42.08 mg) than for ropivacaine (70.8 mg), with a significant p- value of 0.0001.

Both groups showed effective analgesia, with similar VAS scores, highest levels of sensory block, and maternal satisfaction. Halpern and Walsh [73] also reported no differences in analgesia quality or maternal satisfaction, providing excellent labor analgesia. Our study confirmed that both Group B and Group R received excellent analgesia, with no statistically significant differences between the groups.

Overall, the local anesthetic concentrations used in our study resulted in good maternal satisfaction, stable hemodynamics, fewer instrumental deliveries, and no complications.

CONCLUSION:

Our study evaluated the efficacy of intermittent epidural bolus top-ups using 0.125% bupivacaine with fentanyl versus 0.25% ropivacaine with fentanyl for labor analgesia. Both the bupivacaine (B) and ropivacaine (R) groups provided effective pain relief without significant motor blockade, ensuring their safety.Neither medication was associated with prolonged labor duration or adverse maternal and fetal outcomes. Ropivacaine at 0.25% concentration with 2 mcg/mL fentanyl demonstrated a faster onset of analgesia and a longer duration of action compared to bupivacaine with the same fentanyl concentration. Both groups reported comparable levels of maternal satisfaction and achieved satisfactory pain control during labor.

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