International Journal of Medicine Research
ISSN: 2455-7404
www.medicinesjournal.com
Volume 3; Issue 2; April 2018; Page No. 29-31

Comparative study of bolus (top up) bupivacaine and bupivacaine continuous epidural infusions in obstetric patients for labor analgesia

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Abstract
Aims and Objectives: To compare the total bupivacaine consumption per hour of labor and the degree of motor block using the Modified Bromage score at regular intervals throughout labor.
Study Design: The study was a prospective, randomized, comparative study.
Materials and Methods: We included 50 patients, ASA physical status I, nulliparous women at term and cervical dilation < 4 cm admitted at our hospital for spontaneous labor.
Patients were divided into two groups Group A and B. Epidural analgesia was initiated with 10 ml 0.125% Bupivacaine and maintained with solution of 0.0625% Bupivacaine and Fentanyl 2 μg/ml in both groups. Group A (25 patients) received intermittent epidural bolus 10 ml every hour beginning 45 minutes after the initial dose. Group B (25 patients) received continuous infusion 10 ml/h, beginning immediately after the initial dose.
Statistical Analysis Used: Data were analysed by Unpaired 't' test and $\chi 2$ value applied. A value of $P<0.05$ was regarded as statistically significant.
Results: The median adjusted bupivacaine consumption per hour of delivery was in the first group 10.4 mg (9.4 - 12.6mg) and 8.6 mg (6.9 - 10.2mg) in the second group. There was significant difference between the two groups in the percentage of patients requesting manual bolus doses for breakthrough pain (58% intermittent epidural bolus vs 38% continuous epidural infusion) and in the need for multiple boluses (18% intermittent vs 11% continuous). Motor block was registered in only 2 patients (5.2%) in the second group (Modified Bromage 1)
Conclusion: Maintenance of epidural analgesia with continuous epidural infusion compared with intermittent epidural bolus top up decreased bupivacaine consumption without decreasing patient comfort or satisfaction.

Keywords: epidural block, labor analgesia, bupivacaine, observer pain score

Introduction
The pain of childbirth is the most severe pain most women will endure in their lifetimes.
According to the American Society of Anesthesiology (ASA) "in the absence of a medical contraindication, maternal request is a sufficient medical indication for pain relief during labor"
Most of the Indian parturients still suffer from agony of labor pains due to lack of awareness. Enhanced patient safety and satisfaction have contributed to growing use of epidural labor analgesia. Reduction in total dose of local anesthetic and thus motor blockade is crucial to improve the obstetric outcome. Studies that compare the modes of epidural drug delivery during labor from the Indian clinical scenario are lacking.
We hypothesized that continuous infusion of low concentration local anesthetic (0.125% bupivacaine) plus fentanyl (2ug/ml) via the continuous epidural technique would offer safe and superior quality labor analgesia by reducing total amount of the drug combination. We designed a study to compare the intermittent bolus top up administration of 0.125% bupivacaine with 2ug/ml fentanyl to continuous infusion during labor.
The primary outcome was to evaluate the analgesic efficacy of both routes of epidural drug delivery in terms of visual analogue scale (VAS) score, total drug dose and incidence of pain that required top-up administration (breakthrough pain). The secondary outcomes were to measure the degree of motor blockade.

Aims and Objectives
The compare the total bupivacaine consumption per hour of labor and the degree of motor block using the Modified Bromage score at regular intervals throughout labor.

Material and Methods
Fifty term primi or second gravida healthy parturients in labor requesting epidural analgesia were recruited in this study. Written informed parental consent was obtained for each subject under strict aseptic precautions, lumbar epidural space was located by the loss of resistance technique at L_3-L_4 or L_2-L_3 interspinous space with 18 G Tuohy's needle in left lateral Analgesia initiated with 0.125% bupivacaine with fentanyl 2ug/ml.
Patients were randomized to receive bupivacaine 0.125% with fentanyl 2ug/ml via either intermittent bolus top ups (Group A) or continuous infusion (Group B) on an hourly basis Exclusion criteria included contraindications to epidural block. No IV sedatives or opiods were administered.

Heart rate (HR), Systolic Blood Pressure (SBP), and peripheral oxygen saturation (SpO_2) were recorded every 5 min after the placement of epidural anesthesia and foetal heart rate montoring was done on an hourly basis. VAS score, sensory level by absence of sensation to pin prick and motor blockade by Bromage scale were recorded every 15 min till the next 1 h and then on ½ h basis till delivery. Ringer lactate at the rate of 100ml/hour given as maintenance.

If the parturient complained of pain and visual analog scale (VAS) score was >3, an additional bolus of the study drug was given.

Motor block was assessed on awakening by using a modified bromage scale that consisted of 4 points: 0 = full motor strength (flexion of knees and feet), 1=flexion of knees, 2=little movement of feet only, 3=no movement knees or feet.

Each patient was observed for in the recovery room till the shifting into the labor room. When crowning of the fetal head was seen, parturients were made to lie in lithotomy position with the head up and a bolus of 5 mL of study drug was given epidurally. The study ended at the time of delivery or when it was decided to perform a cesarean section.

Statistical analysis used

Data were analysed by unpaired 't' test and $\chi 2$ value applied. A value of $P<0.05$ was regarded as statistically significant.

Results

Patient's demographics were similar and fairly comparable in both groups and differences were statistically not significant. Duration of analgesia using mean Visual Pain Score (VPS) was plotted and it revealed that the mean VPS is quite similar for the two groups.

The median adjusted bupivacaine consumption per hour of delivery was in the first group 10.4 mg (9.4 - 12.6mg) and 8.6 mg (6.9 - 10.2mg) in the second group.

There was significant difference between the two groups in the percentage of patients requesting manual bolus doses for breakthrough pain (58% intermittent epidural bolus vs 38% continuous epidural infusion) and in the need for multiple boluses (18% intermittent vs 11% continuous). Motor block was registered in only 2 patients (5.2%) in the second group (Modified Bromage 1)

Discussion

Pain is defined as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage". Analgesia improves satisfaction with any technique for labour analgesia, which in turn improves the mothers' feelings of self-control. We did a study on the parturients to find out the better outcomes with either top up epidural infusions or continuous epidural infusions.

In October 2006, Bollag *et al*. did a comparative study between Continuous epidural in fusion versus programmed intermittent epidural bolus for labor analgesia to reduce physician-administered top-ups. They concluded that the number of women requesting a top up was lowest with the programmed intermittent epidural bolus. In our study, the top up requirements were more in the top up group as the top up was physician administered in our study rather that the programmed intermittent bolus administration.

The importance of reducing motor block to allow ambulation during regional analgesia in labour is still a matter of debate. A reduction in motor block per se does not appear to influence mode of delivery but it remains possible that a recumbent position with or without an epidural may do so. In labouring women without regional analgesia, the upright position or ambulation has been associated with shorter labours, stronger contractions, decreased analgesic requirements and increased maternal satisfaction. The chance to get out of bed was viewed positively by the majority of

Mothers. It has been suggested that allowing mobilization enhances personal autonomy and even improves the parturient's view of her attending physician.

In 1999, R. E. Collis, F. S. Plaat *et al.* did a comparative study between midwife top-ups, continuous infusion and patient-controlled epidural analgesia for maintaining mobility after a low-dose combined spinal–epidural block. They studied 133 students. All epidural solutions contained

0.1% bupivacaine and fentanyl 2μgml Motor block was assessed by the mother's ability to straight leg raise (SLR). Four hours after combined spinal–epidural analgesia, 88.1% of women could SLR in group MW, 83.7% in group PCEA and 57.8% in group CI. Total use of bupivacaine was highest in group continuous intermittent group. Analgesia was similar between groups and overall satisfaction was equally high.

This was in contrary with the results of our study where 2 patients in Group B developed motor blockade grade 1 Modified Bromage scale. Total dose of the drug was again less in group B continuous infusion group in our study. These differences may be attributed to the advancement in the infusion pumps since 1999 to this day, being more reliable and sensitive and patient friendly in the developed versions.

In August 1999, Murat Kaynar, MD showed that intermittent bolusing of the epidural catheter has a wider spread, which probably contributes to the better quality of the block in the clinical setting. This hypothesis is currently being investigated at Brigham & Women's Hospital.

In late 90s, Hicks *et al*. compared the two techniques and concluded that infusions resulted in fewer top-up doses, less hypotension and a decrease in non-reassuring fetal heart rate patterns and in caesarean delivery. This was sililar to our study.

Satisfaction was very high in both the groups. Median pain scores were the same in all groups. There were more episodes of moderate pain in the group B, although the same amount of severe pain when analgesia had failed

Conclusion

Continuous Epidural Infusion administration provides a more efficacious route of drug delivery when compared to intermittent bolus top ups by significantly decreasing the total amount of local anesthetic plus opioid requirement without adversely affecting patient safety or maternal satisfaction.

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