THE JOURNAL OF OBSTETRICS AND GYNECOLOGY OF INDIA

The Journal of Obstetrics and Gynecology of India (July–August 2011) 61(4):404–407
DOI 10.1007/s13224-011-0059-y

ORIGINAL PAPER

Low Dose Epidural Analgesia During Labor: Comparison Between Patient Controlled Epidural Analgesia with Basal Continuous Infusion and Intermittent Bolus Technique

Singh Saroj · Singh Ankita · Srivastava Uma

Received: 6 May 2009 / Accepted: 5 April 2011 / Published online: 22 September 2011

Abstract
Objectives To compare the efficacy and safety of patient controlled epidural analgesia with basal continuous infusion versus intermittent bolus for labor analgesia using fentanyl and bupivacaine.
Methods In this prospective study, 60 parturients having singleton term uncomplicated pregnancy in early active labor were included. 30 parturients were allocated to receive patient controlled epidural analgesia + basal continuous infusion (Group-A) and 30 received intermittent bolus on demand (Group-B). Efficacy of technique was assessed in terms of quality of analgesia on 0–10 cm verbal analogue scale. Effect on labor was assessed by duration of labor, mode of delivery, and parturient's satisfaction. Neonatal outcome was measured by Apgar score. Data were expressed as mean ± SD and analysed using Student '*t*' test and chi square test where appropriate. $P < 0.05$ was considered statistically significant.
Results Analgesic efficacy of both the groups was comparable. Maternal satisfaction was better in group A than in group B but the results did not achieve statistical significance. Effect on labor and neonatal outcome were comparable.
Conclusions Both the techniques appear to be safe for the mother and neonate with excellent analgesic efficacy. In a busy obstetric unit with increased demand of epidural analgesia, patient controlled epidural analgesia with basal continuous infusion may be preferred.

Keywords Patient controlled epidural analgesia · Basal continuous infusion · Intermittent bolus · Fentanyl · Bupivacaine

Introduction

Labor results in severe pain in most women and epidural analgesia is well established technique to alleviate the pain for over 50 years. After the initial loading dose, several techniques have evolved for maintenance of analgesia. These include intermittent boluses by clinicians, continuous infusion and patient controlled epidural analgesia (PCEA). The standard method of intermittent 'top-ups' by clinician can lead to dramatic swings in women's comfort due to unavoidable delays in delivery of subsequent injections [1]. Continuous epidural infusion provides a method of avoiding the swings of pain as a consequence of the wearing of the intermittent 'top-ups' [2]. However, anaesthetist intervention is required sometimes to adjust the infusion rate when analgesic requirement changes due to change in pattern of labor [3].

Singh S. (✉) · Singh A. · Srivastava U.
S.N. Medical College, Agra, India
e-mail: drsarojsingh@hotmail.com

PCEA is an attractive and suitable technique for management of labor pains. It was first described by Gambling et al. in 1988 during labor. The technique of PCEA utilizes a demand button which the laboring women presses to deliver a prefixed dose of epidural medication whenever she experiences pain. The technique is well accepted by parturients as well as obstetricians in western countries. But little data is available for Indian women.

The purpose of the present study was to determine whether PCEA + Basal continuous infusion could provide satisfactory labor analgesia and to evaluate if it has any additional effect on maternal and neonatal outcome compared to intermittent bolus technique.

Methods

This was a prospective study conducted on 60 women who were admitted in the Department of Obstetrics and Gynaecology, S.N. Medical College, Agra. Approval from Institutional Ethical Committee was obtained. Included were singleton term uncomplicated pregnancy with vertex presentation in early active labor. All cases were evaluated by detailed history taking, general and obstetrical examination.

Exclusion criteria were pre-eclampsia, malpresentation, cephalopelvic disproportion, previous cesarean section, antepartum hemorrhage, medical disorder, bleeding disorder or other contraindications to epidural analgesia. Prior to the procedure intravenous access was established. Epidural catheter was placed in L2-4 position.

All the women were given loading dose of 10 ml of 0.1% bupivacaine + 50 μg fentanyl epidurally and then randomly allocated into two groups. Group A ($n = 30$) received continuous infusion of 0.1% bupivacaine + 2 μg/ml fentanyl @ 6 ml/h with patient controlled bolus of 3 ml of the same solution if needed with lockout interval of 10 min (PCEA + BCI group). Group B ($n = 30$) received intermittent bolus of 10 ml of 0.1% bupivacaine + 2 μg/ml fentanyl on demand by the women (intermittent bolus group). PCEA was delivered using infusion pump (Fresenius Vial S.A., Le Grand Chemin, 38590 Brezins-France). Fetal condition was monitored by continuous cardiotocographic study. Efficiency of the technique was assessed in terms of quality of analgesia on 0–10 cm verbal analogue scale (VAS), time for onset of analgesia (i.e. VAS ≤ 3), number of supplementary doses required and local analgesic consumption. Effect on labor was assessed by duration of labor, mode of delivery, intrapartum and postpartum complications. Apgar score and NICU admission rate measured neonatal outcome. Data were expressed as mean ± SD and analysed using Student '*t*' test and chi square test where appropriate. $P < 0.05$ was considered statistically significant.

Using data from previous studies comparing standard intermittent bolus epidural analgesia to continuous infusion + PCEA, a sample size of minimum 30 patients per group was calculated with a study power of 90% to detect a statistically significant difference in verbal analogue pain scores.

Results

The groups were well matched with respect to maternal characteristics. There were 14 primigravida and 16 multigravida in each group. Cervical parameters were comparable between the two groups at the initiation of study (Table 1). The mean time of onset of analgesia was almost equivalent in group A and group B (12.4 ± 2.92 and 13.3 ± 3.24 min respectively). Duration of analgesia after loading dose was significantly longer in group A (108.5 ± 18.24 min) than in group B (89.17 ± 17.16 min) ($P = 0.0008$). In group A 3.58 ± 0.87 top up doses were required whereas in group B 3.96 ± 1.20 doses were required to maintain effective analgesia during labor ($P = 0.19$). Mean bupivacaine consumption was 54.91 ± 9.25 ml and 49.6 ± 12.2 ml respectively. Time weighed bupivacaine consumption was also comparable between the two groups (Table 2). Mean duration of labor was statistically comparable in the two groups. In group A,

Table 1 Maternal profile

Parameter	Group-A ($n = 30$)	Group-B ($n = 30$)	*P* value
Maternal age (years)	24.37 ± 3.72	24.87 ± 3.92	0.615
Gravida			
Primigravida	13 (43.33%)	13 (43.33%)	–
Multigravida	17 (56.67%)	17 (56.67%)	–
Gestational age (weeks)	38.2 ± 1.03	38.36 ± 1.16	0.484
Cervical dilatation (cm)	3.47 ± 0.51	3.43 ± 0.57	0.776

Table 2 Analgesia characteristics

Parameter	Group-A ($n = 30$)	Group-B ($n = 30$)	*P* value
Onset time (mins)	12.4 ± 2.92	13.3 ± 3.24	0.26
Duration of analgesia after first dose (mins)	108.5 ± 18.24	89.17 ± 17.16	0.00008
Top up doses	3.58 ± 0.87	3.96 ± 1.20	0.19
Bupivacaine consumption (ml)	54.91 ± 9.25	49.6 ± 12.2	0.79
Time weighed bupivacaine consumption (ml/h)	9.74 ± 0.61	9.21 ± 1.33	0.065

Table 3 Effect of labor and maternal outcome

Parameter	Group-A ($n = 30$)	Group-B ($n = 30$)	P value
Duration (mins)			
1st stage	291.08 ± 56.97	278.25 ± 60.21	0.43
2nd stage	50.80 ± 19.66	47.80 ± 21.72	0.61
3rd stage	7.08 ± 1.20	6.59 ± 1.85	0.27
Need for oxytocin augmentation	6 (20%)	9 (30%)	0.37
Cardiotocographic study			
Reassuring	28 (93.33%)	27 (90%)	0.892
Non-reassuring	2 (6.67%)	3 (10%)	
Mode of delivery			
Vaginal	26 (86.67%)	27 (90%)	0.68
Caesarean	4 (13.33%)	3 (10%)	
Complications			
PPH	2 (6.67%)	1 (3.33%)	
Perineal tear	–	–	
Retained placenta	–	1 (3.33%)	

Table 4 Neonatal outcome

Parameter	Group-A ($n = 30$)	Group-B ($n = 30$)	P value
Apgar score			
1 min	5.9 ± 1.18	6.03 ± 1.19	0.673
5 min	8.37 ± 1.03	8.43 ± 0.93	0.814
Birth weight (kg)	2.74 ± 0.32	2.73 ± 0.27	0.896
NICU admission	1 (3.33%)	1 (3.33%)	–

4 cases required cesarean section whereas in group B, 3 cases required cesarean section. None of the cases required instrumental vaginal delivery. Intrapartum and postpartum complications were comparable in both the groups (Table 3). In both group A and group B, 1 neonate had Apgar score < 7 at 5 min and required admission in NICU. There was no neonatal mortality in either group (Table 4). Mean VAS score at initiation of study was 8.97 ± 0.76 and 9.23 ± 0.73 and at 15 min was 2.17 ± 1.29 and 2.53 ± 1.19 cm, respectively in group A and B. Mean VAS was <3 cm at all subsequent evaluation in both the groups. Parturient satisfaction was better in group A than in group B though the results did not achieve statistical significance. Similarly 83.33% cases were willing for epidural analgesia in next pregnancy in group A whereas in group B 73.33% were willing for the same in next pregnancy (Table 5).

Table 5 Efficacy of aAnalgesia

Parameter	Group-A ($n = 30$)	Group-B ($n = 30$)	P value
VAS score (cm)			
At initiation	8.97 ± 0.76	9.23 ± 0.73	0.18
15 min	2.17 ± 1.29	2.53 ± 1.19	0.31
Maternal satisfaction			
Excellent	20 (66.67%)	17 (56.67%)	0.43
Good	6 (20%)	4 (13.33%)	
Average	3 (10%)	6 (20%)	
Poor	1 (3.33%)	3 (10%)	
Willing in next pregnancy			
Yes	25 (83.33%)	22 (73.33%)	0.34
No	5 (16.67%)	8 (26.67%)	

Discussion

The results of the present study demonstrated that both the regimens of providing labor analgesia were equivalent in conferring pain relief. None of the techniques prolonged the duration of labor or influenced mode of delivery or neonatal Apgar scores. The total dose of bupivacaine consumed was similar in each group. Our results are in agreement with several previous studies [2, 4].

In both the groups we used lower concentration of bupivacaine (0.1%) to avoid the decrease of intensity of uterine contraction also to allow the women to bear down effectively. To provide effective analgesia fentanyl was added which further reduced the amount of bupivacaine needed during labor [1, 5].

We instituted epidural analgesia only after confirming that the Friedman curve had entered the active phase of labor, as few studies reported that chances of operative delivery increase if analgesia is provided early in labor specially in nulliparous women [6].

Despite giving continuous infusion, analgesic consumption was not increased. This is contradictory to the findings of Salim et al. [4] and Collis et al. [3] who reported that the total use of bupivacaine was higher with continuous infusion compared with other techniques; however, overall satisfaction was equally high and increased toxicity was not reported with increased dose infusion in both the studies. The cause of more or less similar doses of bupivacaine in both the groups in our study could be due to use of lower basal infusion rate in group-A.

Time of onset of analgesia was comparable in the two groups but the duration of analgesia after first bolus dose was significantly longer in patients receiving continuous infusion probably because we started infusion immediately following loading dose. Several authors have obtained similar onset times [7].

Number of supplementary doses required were comparable in the two groups. Though the amount of drug given as supplementary bolus was significantly different in the two groups, the number of episodes of breakthrough pain

requiring supplementary medication were comparable in the two groups.

The mean duration of stage I and II were comparable in the two groups. Three parturients in the intermittent bolus group had prolongation of second stage of labor but they had no adverse neonatal outcome because of continuous electronic fetal monitoring during second stage of labor.

The number of women requiring caesarean section was similar in both the groups. In all the women, analgesia was continued through the second stage also and thus fewer patients needed perineal infiltration. All the patients could effectively bear down for spontaneous vaginal delivery.

Patient satisfaction was graded as excellent, good, average and poor. More number of women graded analgesic technique to be excellent in the PCEA + BCI group than in intermittent bolus group (66.67% vs. 56.67%) although the difference did not reach statistical significance.

Although both the groups provided equivalent maternal analgesia, higher maternal satisfaction in PCEA + BCI group could be due to feeling of self-control on pain, a finding in agreement with previous results [8].

There is no single set regimen of continuous basal infusion to meet the needs of all women [9]. A high setting of infusion rate may serve the analgesic need of most laboring women. However, increased chances of untoward effects may lower their satisfaction. A low setting of infusion rate may reduce the chances of side effects but may need more additional supplements to relieve breakthrough pain. In the current study we selected a dose regimen of 6 ml/h which has been shown to be effective and does not increase the local analgesic consumption [10].

The technique of PCEA is fascinating as it allows the women to control their dose of epidural medication according to their need and thus can theoretically reduce the side effects (e.g. weakness of legs) [11]. Few disadvantages include high cost of PCA device, time required to programme the device and educate the patient. Some fail to press the demand button due to fatigue or fear of toxicity [11, 12].

In the PCEA + BCI group no women required anaesthetist intervention to give additional dose or adjust the infusion rate. In a busy obstetric unit with increased demand for epidural analgesia, this could reduce the work load of anaesthetist [1, 9], although regular followup was still done by the anaesthetist.

Conclusion

Both the techniques appear to have no significant effect on course of labor and neonatal outcome and were well accepted by women in labor at our hospital. In a busy obstetric unit with increased demand of epidural analgesia, PCEA + BCI could be preferred as it provides excellent parturient satisfaction and reduces demand on professional time without any adverse effect on maternal and neonatal outcome as compared to intermittent bolus group. However, there were few limitations to our study. Firstly the relatively small sample size may inhibit to convincingly drawing a definite conclusion. Secondly our sample has a mixed parity distribution and level of pain threshold of primigravida is significantly lower than multigravida.

References

1. Campbell DC. Labor analgesia; what's new and PCEA too? Can J Anaesth. 2003;50:R8.
2. Fettes PDW, Moore CS, Whiteside JB, et al. Intermittent vs continuous administration of epidural ropivacaine with fentanyl for analgesia during labor. Br J Anaesth. 2006;97(3):359–64.
3. Collis RE, Plaat FS, Morgan BM. Comparison of midwife top-ups, continuous infusion and patient controlled epidural analgesia for maintaining mobility after a low-dose combined spinal epidural. Br J Anaesth. 1999;82(2):233–6.
4. Salim R, Nachum Z, Moscovici R, et al. Continuous compared with intermittent epidural infusion on progress of labor and patient satisfaction. Obstet Gynecol. 2005;106:301–6.
5. D′Angelo R. Epidural PCA during labor. 2001, ASA Newsletter, 65(11).
6. Nageotte MP, Larson D, Rumney PJ, et al. Epidural analgesia compared with combined spinal epidural analgesia during labor in nulliparous women. N Engl J Med. 1997;337:1715–9.
7. Finegold H, Mandell G, Ramanathan S. Comparison of ropivacaine.1%—fentanyl and bupivacaine.125%—fentanyl infusion for epidural labor analgesia. Can J Anesth. 2000;47:740–5.
8. Sia AT, Lim Y, Ocampo C. A comparison of basal infusion with automated mandatory boluses in parturient-controlled epidural analgesia during labor. Anesh Analg. 2007;104:673–8.
9. Chen SH, Liou SC, Hung CT, et al. Comparison of patient-controlled epidural analgesia and continuous epidural infusion for labor analgesia. Chang Gung Med J. 2006;29:576–82.
10. Theonaz N, Boselli E, Stoian A, et al. Role of background infusion during labor PCEA with 0.0625% levobupivacaine plus 0.5 μg/mL sufentanil. Am Soc Anesthesiol. 2006;105:A919.
11. Van der Vyver M, Halpern S, Joseph G. Patient controlled epidural analgesia versus continuous infusion for labor analgesia: a meta analysis. Br J Anaesth. 2002;89(3):459–65.
12. Halpern S. Recent advances in patient-controlled epidural analgesia for labor. Curr Opin Anaesthesiol. 2005;18:247–51.