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Continuous Epidural Infusion of 0.125% Bupivacaine for Pain Relief in Labour: A Comparison with Intermittent Top up of 0.25% Bupivacaine

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Abstract
Background: *Pain is a noxious and unpleasant stimulus which produces fear, discomfort, untold suffering and reflex activity. One of the most distressing variety of pain experienced by mankind is labourpain. Obstetric anaesthesiologists have a tremendous responsibility, since he is answerable to both foetal and maternal outcome. This study was conducted to prove that the continous infusion of local anaesthetic in a low concentration is as efficient as high dose intermittent bolus administration of the same drug with fewer complications.*

Aim

1. Whether the infusion of a relatively low concentration of 0.125 % Bupivacaine provides comparable analgesia.
2. Whether the sensory level reached by infusion technique is significantly lower.
3. Can motor blockade be attenuated by infusion technique so as to augment expulsive efforts during second stage.
4. Influence of the techniques on duration of stages of labour.
5. The incidence of assisted delivery in each group.
6. Whether there is any significant difference in foetal outcome.

Materials & Methods

Study was conducted in sixty four primiparous singleton women in the active phase of labour, during uterine contraction, with vertex presentation and without any bad obstetric history or cephalopelvic disproportion .A full medical & obstetric history was taken ,detailed physical examination done.

Exclusion Criteria

1) CPD
2) APH, previous CS
3) Cardiac disease or PIH
4) IUGR, Bleeding diathesis, Allergy to Local anaesthetics.

Patients were randomly assigned to one of two groups,

Group 1: Intermittent bolus doses of 0.25% Bupivacaine

Group 2: Continous infusion of 0.125% Bupivacaine

Place of study was an isolated cubicle within the labour room with resuscitation cart, emergency drugs, monitoring equipments, Oxygen supply, Anaesthesia machine etc.

Patients were selected when they had adequate true labor pain ie.; pain lasting for 45 seconds to 1 minute and recurring at every 3-4 minutes. At this stage, a P/V exam was done by the gynaecologist. Presenting part, its descent, relation with the pelvis etc were confirmed once again. Cervical dilatation, effacement and consistency of cervix were noted. If the effacement was found 3cm or above, ARM was done and patient was transferred to the cubicle where epidural analgesic technique was conducted.

The patient was instructed to empty the bladder. An intravenous access was started using 18 G cannula and normal saline started slowly. The patient was positioned on right lateral decubitus position over the edge of the table. She was instructed to flex her back by flexion of hips and knees and upper lumbar and thoracic spine. An assistant was instructed to help the patient to maintain the position. After performing epidural puncture with 16 G Tuohy needle at L 3,4 space , epidural catheter is advanced 3 -4 cm cephalad and secured with adhesive tape. A test dose of 3 ml of 0.25 % Bupivacaine is given and during the following 3 minutes interval, patient is observed for any exaggerated spread of analgesia or motor block indicating subarachnoid block.

First Dose

In both the groups the first dose is the remaining 7ml of 0.25% Bupivacaine. During injection, the patient is kept in supine position. After 5 minutes, the parturient is turned to the left lateral position and allowed to remain like that to avoid supine hypotension syndrome. All the patients were nursed either in the left or right lateral position throughout the period of epidural blockade unless specific examinations required her to be placed supine or at the time of delivery. If analgesia was found inadequate after 20 minutes, an additional dose of 2ml of 0.25% Bupivacaine was given in both the groups.

Subsequent Doses

In group 1,(intermittent bolus group),patients top up doses of 10 ml Bupivacaine were given hourly irrespective of the presence or absence of pain.

In group 2, (continuous infusion group), an immediate infusion of 0.125% Bupivacaine prepared in normal saline was started using infusion pump. Speed of infusion was adjusted to get a dose of 10 ml/hour. If analgesia was inadequate in group 2 patients, additional dose of5ml of 0.125% Bupivacaine was given through infusion pump as and when required.

Patients were encouraged to pass urine as and when the bladder was full. Bladder catheter was introduced in patients who were not able to empty bladder by themselves.

When both poles of the presenting part were not palpable per abdomen, the cot was tilted to 60 degree, to make the patient sit up. This was to augment the downward spread of the epidural drug and thereby to block the S 2,3,4 segments which carry pain sensation from the lower vagina and perineum. Tilting was done earlier, if the patient complained of suprapubic or perineal pain/discomfort before disappearance of both poles of the foetal head. This procedure was common to both the groups.

15 minutes after tilting, perineal pain sensation was checked by pin prick. If pain was present, an additional bolus of drug was given in group1,5ml of 0.25% Bupivacaine and in group 2,5ml of 0.125%Bupivacaine through infusion pump.

During the first stage, intravenous fluid was continued to meet maintenance requirements. Oxytocin was avoided in both groups after establishment of epidural block in order to avoid influence on the duration of two stages of labour. Once the full dialatation of cervix was confirmed by the obstetrician, the patient is shifted to labour cot. She was positioned well on the cot taking extra care to avoid an added strain on the joints in those patients with motor block. At the time of crowning, analgesia was checked for episiotomy. If found inadequate, it was supplemented by local infiltration with 1% lignocaine. The ability of the

mother to strain during second stage was assessed by a single obstetrician in all the patients. After delivery and suturing of episiotomy, the epidural catheter was removed and patient kept under observation for a minimum of 3 hours. If the patient was happened to undergo caesarean section, we could provide analgesia very easily with 3ml increments of 2 % lignocaine given through the same catheter till a desired level is obtained.

Observations

1) Degree of pain relief

The degree of analgesia was assessed by a standard 10 point visual analogue scale VAS.A rating of 0 indicated no pain while a rating of 10 indicated maximum pain imaginable. We chose to consider a rating of 3 to be associated with significant pain. If the three successive contractions of this magnitude occurred, an additional top up was given in either group as described previously. These additional drug requirements were noted as failure and were given just for patient discomfort. The more the number of additional bolus requirement, the more would be the failure of that particular technique. In the second stage, the adequacy of analgesia for episiotomy was checked by pin prick method .This was done by the obstetrician and the result was noted as adequate or inadequate.

2) Level of sensory block

Sensory block was assessed by the sensation of cold applied by a cotton swab soaked in spirit. Sensory level was assessed every hour starting 20 minutes after the first bolus dose. Sensory levels 3 hours after establishing block were taken for comparison. Previous studies have shown that the sensory levels do not vary significantly from a median value during the course of labour. Besides at 3 hours, any effect of the initial 0.25%bolus administered for the infusion group can be expected to have waned off.

3) Degree of motor block

Motor block was assessed every half hourly. For comparison, we assessed motor block at 3 hours using modified Bromage scale.

Grade 0: able to flex hip, knee and ankle
Grade1 : able to flex knee and ankle only
Grade2 : able to flex ankle only
Grade3 : unable to move hip, leg and foot

4) Monitoring of foetal heart rate

Was done during all the time of labour. Maternal pulse rate, blood pressure, uterine contraction, its frequency and duration recorded. The findings of P/V examination, cervical dialatation, position of descending vertex, rotation etc are also recorded.

5) Ability to strain in second stage

This was graded as good, moderate or poor by the attending obstetrician who conducted all deliveries in the study and was blinded to the technique employed.

6) Time taken to regain full muscle power

After delivery, patients were observed for a minimum period of 3 hours. The time taken to cease the motor block (ability to flex hip against resistance) was noted.

7) Complications

We also looked for any of the known complications of epidural blockade like shivering, nausea, vomiting, hypotension.(more than 20% drop from baseline systolic BP was taken as hypotension).If hypotension was present, we could control with I/V fluids & Mephenteramine.

8) Progress of labour

The total duration of 1 st stage,2nd stage,3rd stage and the duration from epidural block to full dilatation of cervix were also noted in each group.

9) Foetal Outcome

After delivery, baby was thoroughly examined and APGAR scoring done at 1 minute and 5 minutes.

Table 1: Demographic Tables(Mean Values)

Variables	Bolus group	Infusion group
No.of patients	32	32
Age in yrs	23.6	24.1
Heightin cm	156.12	155.87
Weight in kg	56.4	57.1
Length of Gestation in weeks	40.5	40.0

Table 2: Mean Duration of Stages of Labour

	Bolus group	Infusion group
1st stage	690	654
Extra Dural to full dialatation of cervix(mnts)	510	464
2nd stage	92	76
3rd stage	4.06	3.16

Table 3: Degree of motor block at 3 hours

	Bolus group	Infusion group
Grade 0	40%	75.86%
Grade 1	405	20.69%
Grade 2	20%	3.45%
Grade 3	0	0

Table 4:No.of additional top ups required

	Bolus group	Infusion group
0	83.33%	31.03%
1	13.33%	41.38%
2	3.33%	20.69%
3 & above	0	6.9%

Table 5: Sensory Level

	Bolus group	Infusion group
T10 and below	10%	37.93%
T6 to T 10	80%	62.07%
T5 and above	10%	0

Table 6: Ability to strain in stage 2

	Bolus group	Infusion group
Good	22.22%	69.23%
Moderate	37.04%	19.23%
Poor	40.74%	11.54%

Table 7: Nature of Delivery

	Bolus group	Infusion group
Normal	51.72%	56.67%
Vacuum	37.93%	33.33%
Caesarean	10.35%	10.0%

Table 8: Time taken to regain full muscle power

	Bolus group	Infusion group
< 1 hour	23.33%	51.72%
1 to 2 hours	53.33%	37.93%
>2 hours	23.33%	10.355%

Table 9: APGAR at 1 minute

	Bolus group	Infusion group
7 to 10	93.33%	96.55%
4 to 6	6.67%	3.45%

Table 10: Analgesia for episiotomy(with pinprick 15 mts after tilting)

	Bolus group	Infusion group
Sufficient	92.6%	42.3%
Insufficient	7.40%	57.69%

Table11: Indication for Caesarean

	Bolus group	Infusion group
Foetal distress	2	2
CPD	1	1

Table12: Complications

	Bolus group	Infusion group
Shivering	36.67%	31.03%
Nausea/Vomiting	3.33%	6.90%
Urinary Retention	13.33%	13.79%
Hypotension	10%	6.90%

Bloody Tap	4 patients
Difficulty in threading catheter	2 patients
Failure to act	1 patient

Discussion

Epidural analgesia for labour has attained widespread popularity by virtue of its superior efficacy and when properly conducted, its inherent safety. Maternal and foetal complications are significantly less when compared to parenteral or inhalational techniques.

In the early days of epidural analgesia for labour, the intermittent bolus technique was widely used. Even when administered on a fixed time schedule to abolish painful episodes, high sensory levels, motor blockade of significant degree that interfered with straining efforts during second stage and hypotension do occur with disturbing frequency.

Dawkins, Spoerl et al had underlined the advantages of a continuous infusion technique over the intermittent bolus technique. The total amount of local anaesthetic injected is usually less with the infusion technique. Because of the more dilute solutions that produce comparable analgesia, the degree of motor blockade is likely to be less. This allows greater mobility. Moreover, pelvic tone is likely to be better preserved, thus reducing the incidence of malrotations while augmenting expulsive efforts during the second stage of labour. Hypotensive episodes can also be

expected to be less during infusion epidurals, possibly due to fewer fluctuations in sympathetic block.

In the present study, two groups of patients were compared .One group was administered hourly top ups of 0.25%Bupivacaine while the other group was infused with 0.125% Bupivacaine per hour after an initial bolus of 0.25% Bupivacaine. We specifically focused our attention on the following points with reference to the infusion technique

1. Does the infusion of relatively low concentration of 0.125% Bupivacaine provide complete analgesia?
2. Is the sensory level reached is significantly lower?
3. Can motor blockade be attenuated so as to augment expulsive efforts during second stage?
4. Any less complication compared to intermittent top ups?

Demographic Profile

Patients of both groups were comparable with reference to their age, height, bodyweight and period of gestation (Table 1)

Sensory level Attained

Block of T10 to L1 segments is essential to provide effective analgesia. A sensory block above T5 dermatome is likely to result in significant hemodynamic instability.

Sensory levels 3 hours after establishing block were taken for comparison. Previous studies have shown that sensory levels do not vary significantly from a median value during the course of labour. Besides , at 3 hours any effect of the initial 0.25 % bolus administered for the infusion group can be expected to have waned off. Our results show that sensory levels attained at 3 hours are significantly less with infusion. Only 10 % of patients in bolus group had a sensory level below T 10 as against 37.93 % of patients in the infusion group (Table 4).Nopatient in the infusion group had a block above T6,in contrast to 10 % of patients in the olus group.

Thus we can conclude that continuous infusion does result in a significantly less upward extend of sensory blockade. A higher sensory level would probably be associated with a proportionately higher level of autonomic blockade with a greater hemodynamic instability.

Quality of Analgesia

The quality of analgesia was assessed by a standard 10 point VAS (Visual Analogue Scale).A rating of 0 indicated no pain while a rating of 10 indicated maximum pain imaginable. We chose to consider a rating of 3 to be associated with significant pain. If 3 successive contractions of this magnitude occurred, an additional top up was given in either group as described previously. When neither pole of the presenting part was felt per abdomen, the patient was given a 60 degree propup and perineal analgesia assessed by pin prick 15 minutes later. If analgesia was found inadequate at this stage a top up dose was administered.

In the bolus group, 83.33% of patients did not require any additional dose apart from hourly top up. In contrast, only 31.03% of the patients in the infusion group could be managed without any top up. However with a single additional top up, 72.41%of patients were satisfied (Table 5)

These results reveal that even though the intensity of analgesia with the infusion technique may be marginally low, it is still sufficient in the vast majority of patients, especially with one or two top up doses.

Degree of motor block

One of the disturbing effects of epidural analgesia for labour is motor blockade which results in reduced patient mobility and possible interference with forceful straining efforts during 2nd stage.

We assessed motor block at 3 hours after institution of block using a modified Bromage scale as mentioned previously. The results were revealing 75.86%of patients in the bolus group had grade 0 block, as against only 40% of patients in the bolus group (Table3). Besides, 20% of patients who were given intermittent top ups had grade 2 motor block as against only 3.45% in the infusion group

Ability to strain 2nd stage

The lesser degree of motor block observed in the infusion group was corroborated in the ability of the patient to make expulsive efforts during the second stage. This was graded as good, moderate, or poor by the attending obstetrician who conducted all deliveries in the study, and was blinded to the technique employed.

By this criterion, 69.23% of patients in the infusion group were judged to have good expulsive efforts as against only 22.22% of patients in the bolus group. (Table 7). Thus the lesser degree of motor block in the patients who received infusion technique was reflected as a far better ability to strain during 2nd stage of labour.

Nature of delivery

51.72% of patients in the bolus group and 56.67% of patients in the infusion group delivered normally.(Table 8).The incidence of assisted delivery was relatively high by our hospital standards.37.93%of patients in bolus group and 33.33% of patients in the infusion group required vacuum extraction. Three patients in each group underwent CS.

Complications

Shivering was the most frequent complication (36.67%) in the bolus group and 31.03% in the infusion group.(Table 12).

Time taken to regain full muscle power

Patients who received infusion regained normal muscle power much quicker than those who were given intermittent top ups (Table 9). By 1 hour, 51.72% of patients in the infusion group regained normal muscle power in contrast to only 23.33% in the bolus group. This number increased to 89.65% and 76.66% respectively after 2 hours. Thus the patients who were given infusion could ambulate earlier when compared to their counterparts who received intermittent topups.

Foetal Outcome

Was excellent in both groups. Only 3 newborns in bolus group and 1 in the infusion group required mask ventilation. By 5 minutes, all newborns had an APGAR of 10.

Our study asserts the numerous advantages that occur with the infusion technique to provide epidural analgesia during labour. The quality of analgesia, though not as intense as with bolus group, is sufficient in the vast majority of patients. Also lower sensory level, better preservation of motor power and expulsive efforts during second stage and lesser complications like hypotension. Also less need to monitor patient after each top up.

The potential complications of infusion technique are intravascular or subarachnoid migration of the catheter or the development of progressively higher levels of analgesia with hypotension and ventilator difficulties.

Summary & Conclusion

A prospective trial was designed to assess the effectiveness of two different techniques of Bupivacaine administration for use in obstetric epidural analgesia. Two groups of patients were compared-one group was administered hourly topups of 0.25% Bupivacaine which the other group was infused with 0.125% Bupivacaine per hour after an initial bolus of 0.25% Bupivacaine.

Results show that even though the intensity of analgesia with infusion technique may be marginally low, it is still sufficient in the majority of patients especially with one or more top up doses.

Motor weakness was significantly low in the infusion group compared to the intermittent bolus group and hence the expulsive efforts during 2nd stage of labour was better preserved in infusion group.

Continuous infusion resulted in a significantly less upward extend of sensory blockade .So majority of patients in this group did not experience unpleasant subjective awareness of numbness and paralysis.

The duration of stages of labour was slightly less with the infusion group. It might be due to the maintenance of tone of the pelvic muscles which

facilitate rotation of the presenting part and also due to the preservation of straining ability in 2nd stage.

Incidence of complications like shivering, nausea, urinary retention and hypotension were almost equal in both groups.

APGAR score at 1 minute and 5 minute remained same in both groups.

It was conclusively proved that epidural infusion with 0.15% Bupivacaine is a far more superior technique compared to intermittent bolus administration of Bupivacaine for obstetric epidural analgesia.

Appendix

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