Painless Labor: Comparison between Patient Controlled Epidural Analgesia and Continuous Epidural Analgesia

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ABSTRACT:

BACKGROUND:

Patient-controlled epidural analgesia has been considered as superior to continuous epidural infusion for labor pain control.

AIM OF STUDY:

The aim was to establish the efficacy of Patient Controlled Epidural Analgesia for control of labor pain and improve the quality of analgesia .

METHODS:

This study was done on 20 patients; they were given bolus of 10 ml of 0.125% bupivacaine +2 Mg /ml fentanyl then divided into: Group A can put the device to deliver 5ml of 0.125% bupivacaine +2Mg /ml fentanyl with lockout interval 20 min; Group B had the PCA system to deliver continuous infusion of 10 ml /hr. In each group if patient still suffer from pain, patients were received additional dose of 5ml of same solution.

RESULTS:

Data showed that total amount of LA in group A was lower than group B (18.44ml versus 20ml in 1st hr., 2.5ml versus 10ml in 2nd hr.). Regarding additional boluses, CIEA group needed more extra boluses of LA at 20, and 60 mints (5.0ml versus 1.0ml, 4.0 ml versus 0.5ml).

CONCLUSION:

The use of PCEA associated with lower doses of local anesthetic with better quality of analgesia and maternal satisfaction.

KEYWORDS: Painless labor, patient controlled analgesia.

INTRODUCTION:

Pathways of labor pain

The uterus and cervix are supplied by afferents sympathetic nerves in the uterine and cervical plexuses, the inferior, middle and superior hypogastric plexuses and the aortic plexus [(1)].The small unmyelinated C 'visceral fibers transmit nociception through lumbar and lower thoracic sympathetic chains to the posterior nerve roots of the 10th, 11th and 12th thoracic and also to 1st lumbar nerves to synapse in the dorsal horn [(2)]. The chemical mediators are bradykinin, leukotrienes, prostaglandins, serotonin, substance P and lactic acid [(3).] As the labor progresses severe pain is referred to the dermatomes supplied by T10 and L1. In the second stage, the pressure by the presenting part on the sacral plexus causes neuropathic pain. Stretching of the vagina and perineum result in stimulation of the pudendal nerve (S2, 3, 4) via myelinated, rapidly transmitting 'A delta 'fibers [(1).] The impulses pass to dorsal horn cells and finally to the brain via the spinothalamic

Patient-controlled analgesia

Patient-controlled analgesia (PCA) is a method of pain control that gives the patient the power to control their pain. In PCA, a computerized pump called the patient-controlled analgesia pump, which contains a syringe of pain medication as given by a doctor, is connected directly to a patient's intravenous (IV) line. The pumps allow programming of a bolus dose (given when the patient presses the request button), and a lockout period. The bolus dose cannot be repeat until the time specified in the lockout period has expired [(4)].

Route of Administration

A. Intra-venous

IV- patient-controlled analgesia is the most used techniques for both acute and chronic pain patients. It is commonly used for post-operative pain management, and for end-stage cancer patients [(5).]

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B. Epidural

Epidural patient-controlled analgesia (EPCA) is the most significant method used within the PCA approach. Patient-controlled epidural analgesia (PCEA) is a related term describing the patient-controlled administration of analgesic medicine in the epidural space, by way of intermittent boluses or infusion pumps [6]. This can be used by women in labor, critically ill cancer patients or to manage post-operative pain commonly in patients undergoing orthopedic, abdominal and thoracic surgery. EPCA allow the use of opioids, local anesthetics, or a combination of both [7].

Choice of Local Anesthetic Solutions

The addition of opioids to local anesthetic solutions for epidural analgesia effective relieve the somatic pain of the late first and second stage of labor. The synergy between epidural opioid and local anesthetic solutions gives separate sites of action, the receptors and neuronal axons. When the two are combined, very low concentrations of both local anesthetic and opioid can be used. More importantly, the incidence of side effects, such as hypotension and drug toxicity, is likely reduced [8]

PATIENTS AND METHODS:

This is a randomized clinical trial study was conducted on 20 patients in Gynecology and Obstetrics delivery rooms of Baghdad teaching hospital and nursing home hospital ,Medical city, Baghdad ,Iraq. From the date 1st of July 2017 to 1st of November 2018.

After obtaining the agreement of scientific council of anesthesia and Intensive care of Iraqi board and medical specialization, written consent was obtained from all patients. ***Inclusion criteria*** *include (*Multiparous women scheduled for normal vaginal delivery (cervical dilatation 4-5 cm), ASA : II, Age : 18-45 years old, Weight: 60-100kg, Height: 150 -175cm) .***Exclusion criteria(*** Any absolute or relative contraindication to epidural anesthesia, Non vertex fetal presentation, multiple gestations, fetal malformation, Patient with abnormal vertebrae, scoliosis, lordosis, Patient already have taken analgesia, Patient with previous cesarean section**).**

Data were done using preconstructed form sheet, history was taken from each patient, about medical history, age, height, and weight.

General examination, vital signs measurements were taken. Monitors (NIBP, HR, SPO2, and Fetal HR) were attached to the patient. Maternal hemodynamic measurements were recorded.

Wide bore intravenous cannula was inserted for all patient and they were received 1liter of crystalloid (0.9% normal saline) over 2hrs , epidural analgesia was performed for all patient as following**:** under full aseptic technique patient was in sitting position, at the level L4_L5 interspace ,using midline approach local infiltration with 2% lidocaine was done,18 gauge Tuhoy needle (B_Braun Germany)was inserted in the epidural space with loss of resistance technique ,then a test dose was given 3ml of 1.5% of lidocaine +5Mg/ml epinephrine 1:200,000 through the epidural catheter ,after 5 minutes followed by 10ml of 0.125% bupivacaine+2Mg/ml fentanyl to ensure adequate analgesia .After that we attach the epidural catheter to the device. We use a device adapted from smith medical company, patients then divided into two groups: Group A had the PCA set can trigger the device to deliver 5ml of 0.125%bupivacaine +2Mg /ml fentanyl with lockout interval 20 min., and Group B had the PCA system to deliver continuous infusion of 10 ml /hr. each contain 1.25mg bupivacaine +2 Mg/ml fentanyl. In each group between them if patient still complains of pain that assessed by numerical analogue scale, patients were received supplemental dose of 5ml of 0.125% bupivacaine +2Mg/ml fentanyl. Overall quality of analgesia was assessed using a numerical analogue scale representing taking opinion of patient for assessing the degree of pain experience on a scale of 0_10 (0 no pain, (1-3) mild, (4-6) moderate,(7 -10) severe).the scale of 0 for more satisfied and 10for the least satisfied was used for assessing pain score every 30 minutes interval. Sensory analgesia was assessed by loss of sensation to temperature, and degree of motor block was assessed by a modified bromage score (0_no motor block, 1_hip blocked 2_hip and knee block, 3_hip, knee, ankle block).Patients were assessed at 20 minutes after epidural insertion then every 30 minutes interval. Maternal blood pressure was measured every 5 minutes after epidural insertion for 15 minutes and then every 30 minutes interval. Fetal heart rate was continuously monitored during labor and neonates were assessed by Apgar score at one and five min. A decrease in mean arterial blood pressure >20%from baseline consider as clinically hypotension and treated with crystalloid infusion if no response despite crystalloid infusion , vasopressor (3_6mg ephedrine) intravenous would be given.

Statistical Analysis

The data analyzed using Statistical Package for Social Sciences (SPSS) version 25. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Independent t-test (two tailed) was used to compare the continuous variables among study groups accordingly. A level of P – value less than 0.05 was considered significant.

RESULTS:

3.1. General Characteristics

Regarding mode of delivery, all patients were delivered by spontaneous vaginal delivery. In comparison between study group by age, and duration of delivery stages, we noticed that there were no significant differences (P ≥ 0.05).

Table 3.1: Comparison between study groups by age, BMI, and duration of delivery stages.

Variable	Study Group		P- Value
	PCA Mean ± SD	CEA Mean ± SD	
Age (Years)	27,27 ± 5,37	27.1 ± 4.77	0.939
Duration of First Stage (mints)	64.5 ± 19.21	63.5 ± 11.31	0.889
Duration of Second Stage (mints)	21.5 ± 7.09	19.5 ± 5.5	0.49

3.2. Clinical parameters

3.2.1. Mean Arterial Pressure (MAP)

The comparison between study groups by the amount of change in MAP at each time from the baseline score. Shows no statistical significant difference (P ≥ 0.05) in mean difference of MAP after 20, 60, 90 and 120 mints between study groups.

3.2.2. Maternal Heart Rate

The comparison between study groups by the amount of change in maternal heart rate at each time from the baseline score. Shows no statistical significant difference (P ≥ 0.05) in mean difference of maternal heart rate in all times between study groups.

3.2.3. Fetal Heart Rate

The comparison between study groups by mean of fetal heart rate. There were no statistically significant differences (P ≥ 0.05) between studies groups in means of fetal heart rate at all times during labor.

3.3. Amount and Supplement of LA

Regarding amount of LA, the mean after 20 and 60 mints was significantly higher among CEA group than that in PCA group.

There were no significant differences (P ≥ 0.05) between study groups in amount of LA after 120 mints. Concerning supplement of LA, the mean after 20 and 60 mints was significantly higher among CEA group than that in PCA group.

Table 3.2: Comparison between study groups by amount of LA.

Time	Amount of LA		P – Value
	PCA Group Mean ± SD	CEA Group Mean ± SD	
Baseline	1٠.0 ± ٠	10.0 ± 0	1.0
After 20 Mints	4.0 ± 2.1	10.0 ± 0	0.001
After 60 Mints	4.44 ± 1.66	10.0 ± 0	0.001
After 90 Mints	0	10.0 ± 0	-
After 120 Mints	2.5 ± 3.53	10.0 ± 0	0.333

Table 3.3: Comparison between study groups by supplement of LA.

Time	Supplement of LA		P – Value
	PCA Group Mean ± SD	CEA Group Mean ± SD	
After 20 Mints	1.0 ± 2.1	5.0 ± 0	0.001
After 60 Mints	0.55 ± 1.66	4.0 ± 2.1	0.001

3.4. Apgar Score of neonates

We noticed that there were no statistically significant differences ($P \geq 0.05$) between study groups in means of Apgar score of neonates after one and five mints.

Table 3.4: Comparison between study groups by mean Apgar score of neonates.

Apgar Score of neonates	Study Group		P - Value
	PCA Mean ± SD	CEA Mean ± SD	
One Mint	9.3 ± 1.88	9.7 ± 0.48	0.209
Five Mints	10 ± 0	10 ± 0	1.0

3.5. Motor Weakness

We noticed that there were no cases with motor weakness detected for all study patients in both groups.

3.6. Numerical analogue scale (NAS)

The mean difference in NAS after 20 mints and 60 mints compared to baseline score was more decreased in PCA group than that in CEA group and this decrement was statistically significant .No statistically significant difference ($P \geq 0.05$) in mean difference of NAS after 90 and 120 mints between study groups.

Table 3.5: Comparison between study groups by the degree of change in NAS at each time from the baseline score.

Mean Difference in NAS	PCA Group Mean ± SD	CEA Group Mean ± SD	P – Value
After 20 Mints from Baseline	- 4.6 ± 0.84	- 3.1 ± 0.56	٠,٠٠1
After 60 Mints from Baseline	- 5.77 ± 1.3	- 4.1 ± 1.28	0.012
After 90 Mints from Baseline	- 6.4 ± 0.89	- 6.5 ± 0.75	0.832
After 120 Mints from Baseline	- 6.5 ± 2.12	- 7.0 ± 0	0.879

DISCUSSION:

Epidural analgesia for labor and vaginal delivery are the most common and effective technique used for pain relief in labor. Maintenance technique for epidural labor analgesia has been changed from intermittent manual bolus to PCEA to (CEI) with or without (PCEA). [9] . ***Sheng-Huan Chen et al*** supported our study when conducted his RCTs study on 179 patients and divided randomly into two groups CEI using 0.08% Ropivacaine and 2 µg/mL fentanyl mixture, was infused with a pump at a rate between 8 to 12 mL/h and PCEA using 6ml with lockout interval 5 mints. Additional analgesia was given at 6 mL 0.25% ropivacaine in either group and the continuous infusion rate in CEI group was adjusted in increments of 2 mL/hour. And showed no statistical difference in duration of 1st and 2nd stages, age, Apgar score at 1st and

5th min., motor blockade, between the PCEA and CEI groups. (P>0.05) and in regarding to total number of rescue dose of LA was less in PCEA than CIEA (3.7 %versus 49 % respectively) ,also showed that PCEA improve parturient satisfaction and reduce the workload of both doctors and nurses [10]. Also, we are agreement with ***M. van der Vyver1et al*** which demonstrated from his RCTs study conducted on 130 patients when compared between two groups PCEA without background infusion and CIEA, showed no significant difference between two groups regarding Apgar score at 1st and 5th minute, motor blockade , duration of 1st and 2nd stage of labor , maternal MAP. (P>0.05) [11].Their results compatible with our study. And in regarding to amount of LA our study was agreed with ***N. BROGLY et al.*** who conducted the RCTs study on 40 multiparous patients which divided randomly into two groups,1st group (PCEA) used 0.125% of levobupivacaine +1.5 Mg/ml fentanyl(10ml bolus with 20 lockout interval),2nd group PCEA plus background infusion received 10ml/hr. which showed reduction in total volume of local anesthetic in PCEA in compared PCEA +background infusion ($p<0.001$)[12].

Concerning supplemental boluses of LA, our results showed that group A (PCEA) need less supplemental doses of bupivacaine and fentanyl than group B (CIEA) which was supported with ***Sumaiah Tahseen et al*** that conducted his study (RCTs) to compare between (PCEA) group and (CEI) group used 0.125% of bupivacaine +2.5 Mg\ml fentanyl showed less amount of rescue supplemental doses in PCEA compared to CEI ($p<0.001$)[13]. ***Y. Lim et al*** also reported from RCTs conducted on 60 multiparous patients when compared randomly between two groups :The first group CEA received a continuous epidural infusion of levobupivacaine 0.1% with fentanyl 2 µg/mL at a rate of 10 mL/h. The bolus group received 5-mL epidural boluses every half hour. The rescue dose was 5 ml of same solution .His result approved the bolus group had a lower incidence of breakthrough pain than the infusion group (10% vs. 37%, $P < 0.05$). The bolus group also had significantly higher satisfaction scores for labor analgesia: ($P < 0.05$) [14].These results compatible with our study in regard pain score (NAS).While other study in regarding to pain score , ***N. BROGLY et al*** who conducted the study on 40 multiparous patients ASAII, >18 years old disagreed with our results when compared randomly between 1st group (PCEA) used 0.125% of levobupivacaine +1.5 Mg/ml fentanyl(10ml bolus with 20 lockout interval),2nd group PCEA plus background infusion received 10ml/hr. which showed reduction in total volume of LA in PCEA in compared PCEA +background infusion but no significant difference in pain score (VAS) at 30 mints (P=0.39)and comparable at all times of labor between two groups and maternal satisfaction was high between two groups (A=(8-10),B=(7-10),p=0.11),may be due to use PCEA protocol with high volume boluses (10ml) and long lockout interval is used for labor analgesia, could represent satisfactory even without background infusion that increased the total local anesthetic dose with no change in pain score and maternal satisfaction. [15].And this result not compatible with our study.

CONCLUSION:

In multiparous women requesting epidural analgesia for labor pain and normal vaginal delivery, the use of PCEA associated with lower amounts of LA, lower rescue supplemental boluses, with better quality of analgesia and maternal satisfaction in comparison to CIEA.

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