DEXAMETHASONE AS ADJUVANT TO CAUDAL ROPIVACAINE AS ANALGESIC FOR LABOR PAIN

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Abstract

***Objectives**: To evaluate analgesic yield of dexamethasone (DEX) as adjuvant to caudal ropivacaine (ROP) for labor pain. **Patients & Methods**: 414 primigravida in their active phase of the first stage of labour divided randomly into two groups: ROP group received caudal ropivacaine and DEX group received caudal combination of ropivacaine and dexamethasone. Assessment included extent of sensory and motor blockade and requirement of anaesthesia for episiotomy repair and evaluation of post-episiotomy pain and postpartum complications. **Results**: Sensory blockade data showed a profound analgesic effect in both groups with superior effect in DEX group manifested as significantly earlier onset of analgesia in association with significantly prolonged duration of analgesia. Caudal block did not disturb process of delivery with non-significant difference between both groups. Twenty nine parturient had caesarean section and 385 had vaginal delivery. Episiotomy was repaired without perineal infiltration anaesthesia. Postpartum perineal pain scores were significantly lower in DEX group with significantly higher low pain scores and significantly request for analgesia for episiotomy related pain. **Conclusion**: Caudal ropivacaine/dexamethasone provided safe profound labor analgesia without interruption of progress of labor and spared the need for perineal anaesthesia for episiotomy repair and minimized the need for subsequent analgesia.*

Key-words: Dexamethasone; Ropivacaine; Caudal block; Labor pain

Key messages:

We do believe that such modification provides safe profound labor analgesia. It doesn't interrupt the progress of labor. It also spares the need for perineal anesthesia for episiotomy repair and minimizes the need for subsequent analgesia.

Introduction

Labor pain is a continuous distressing spasmodic contractions alternating with sense of painful cervical dilatation. In primigravida labor pain is intensified by ignorance of its nature which lowers pain threshold thus intensifying pain sensation and prolongs its duration. These criteria indicated the need for continuous analgesia without abolishing the reflex of uterine contraction-cervical dilatation and without motor weakness to allow the use of perineal muscles. Also, adequate pain control during childbirth may reduce maternal anxiety and thus may make childbirth become a satisfactory procedure. [1, 2]

These prerequisites could be the characters of caudal analgesia which allows anaesthesia for lower abdominal and perineal dermatomes without affecting muscle power of the lower limbs to permit mobility. Ropivacaine with its motor nerves sparing affinity intensified these effects and its favourable toxicity profile for epidural anaesthesia in adults with less toxic insult on central nervous system than bupivacaine could potentially be of great benefit for provision of proper

analgesia during childbirth with minimal effect on the progress of labor. [3, 4]

Multiple studies evaluated various additives to be used in combination with local anaesthetics for improvement of analgesic outcome of neuroaxial analgesia; ***Goodman et al.*** [5] found intrathecal epinephrine does not prolong the duration of fentanyl or fentanyl with bupivacaine for labor analgesia in nulliparous parturient or decrease the incidence of side effects and therefore cannot be recommended. ***Lee et al.*** [6] reported significant pain relief with epidural ropivacaine/fentanyl and concluded that the quality of analgesia was significantly improved by the addition of fentanyl to ropivacaine. ***Kumar et al.*** [7] evaluated the analgesic effect of caudal bupivacaine with or without ketamine, midazolam and neostigmine and reported that the time to first analgesic administration was significantly longer in the bupivacaine-neostigmine group than in the other groups.

Dexamethasone is a well-known anti-inflammatory drug started to be investigated for its analgesic efficacy, however, up till now still there is some points of controversy concerning the route of administration whether systemic [8] or regional [9], its additive analgesic effects if administrated as adjuvant, [8] the mechanism and site of its analgesic action and timing of administration. [10, 11]

Thus, the current prospective comparative study aimed to evaluate the analgesic yield of dexamethasone as adjuvant to caudal ropivacaine for labor pain in primigravida committing labor.

Subjects & Methods:

The study was conducted in the period from 4 2009 to 4 2011.in the department of obstetrics kasr elaini hospital Cairo university. After doing sample size calculation, the study protocol was approved by the Local Ethical Committee and parturient and/or husbands' were fully informed about the study protocol prior to enrollment and those accepted gave their written consent to participate. The study enrolled 414 primigravidas with full term pregnancies and singleton vertex cephalic fetuses, and all of them were in the active phase of the first stage of labor. Parturient with medical diseases, premature rupture of membranes, history of pyuria or fever of unknown cause, a known history of bleeding diathesis, allergy to local anaesthetics, or pre-existing neurological or spinal disease were excluded of the study.

After assessment of the maternal and fetal condition, parturient were randomly, using sealed envelops, allocated in two main groups: ROP group comprised 207 women assigned to receive caudal ropivacaine 0.15% alone and DEX group comprised 207 women assigned to receive caudal ropivacaine 0.15% mixed with dexamethasone in a dose of 0.2 mg/ml. No additional analgesia was provided for labor pain so as to equalize both groups against augmentation or enhancement. The attendant obstetrician was blinded about the medication used for caudal block.

With the patients in the left lateral position, and after local infiltration of the skin, a caudal block was performed using a 23-gauge short bevel needle under sterile conditions. Then, a 17-gauge Touhy needle. After a negative aspiration for blood or CSF, 10 ml of study solution was slowly administered between uterine contractions through the Touhy needle over a 60-s period. Then, the parturient was returned to a left lateral supine position.

Patients monitoring included: [1] Baseline heart rate, blood pressure and respiratory rate were determined and were monitored thereafter and the mean of intraparteum data were recorded and compared versus the baseline values. [2] Sensory blockade was registered bilaterally by pinprick method using a blunt needle. Onset of pain relief was assessed at each uterine contraction using a four-graded verbal analogue scale: 1: no pain relief, 2: a little pain relief, 3: a lot of pain relief, and 4: complete pain relief, onset of pain relief signified the time when grade 3-4 had achieved. [12]

Duration of analgesia was determined since onset of start till onset of regression of analgesia. [3] Motor blockade of the lower limbs was tested and scored as follows: 0= no motor block means that the patient was able to flex knees and legs freely and can ambulate without aiding and 1= unable to raise the extended legs but able to move the knee and feet and so unable to ambulate. [4] Evaluation of progress of labor by the cardiotocogram (CTG) and the following data were collected: 1) the duration of the 1st stage of labour, 2) the duration of the 2nd stage of labor, 3) fetal heart rate, 4) the frequency and time of occurrence of spontaneous rupture of membranes, 5) colour of liquor, 6) the mode of delivery and 7) the occurrence of postpartum complications were recorded. [5] Episiotomy related pain was graded on verbal analogue pain scale consisting of: 0=no pain, 1=mild pain, 2=moderate pain and 3=severe pain. [12]

Rescue analgesia was prescribed on request and if pain score at least was 2 and was in form of declophenac sodium intramuscular injection and repeated if required.

Results:

Both study groups showed non-significant difference as regards maternal age and weight and gestational age, (Table 1) or baseline blood pressure measures, heart rate or respiratory rate. Moreover, mean of intrapartum vital data showed non-significant difference compared to baseline data and between both groups, (Table 2).

Table (1): Patients enrollment data

	ROP group	DEX group
Maternal age (years)	25.8±3.1 (19-31)	24.5±3.2 (20-29)
Maternal weight (kg)	87±3.1 (78-93)	87.4±2.9 (79-93)
Gestational age (days)	289±3.8 (285-298)	290.1±3.6 (284-297)

Data are presented as mean±SD, ranges are in parenthesis.

Table (2): Mean (±SD) baseline and intrapartum vital signs

		SBP (mmHg)	DBP (mmHg)	HR (beat/min)	RR (breath/min)
ROP group	Baseline	129±4	80.8±3.7	84.2±4.5	19.2±1.8
	Intrapartum	128±4.7	80.6±4.8	81.1±3	18.6±1.5
DEX group	Baseline	128.1±8.9	79.3±5.2	79.4±5	19.4±1.5
	Intrapartum	131±3.6	82.8±4.8	88.8±4.7	20.4±1.9

Sensory blockade data showed a profound analgesic effect of both modalities of caudal analgesia. However, caudal blockade in DEX group provided superior analgesic effect manifested as significantly earlier onset of analgesia in association with significantly prolonged duration of analgesia. Ropivacain in the used dose did not induce manifest motor blockade and only 41 parturient (9.9%) complained of slight weakness of lower limbs but not limiting their ability to move around the room. There was non-significant difference between both groups considering the frequency of parturient free of motor blockade (Table 3).

Table (3): Sensory and motor blockade data

	ROP group	DEX group	F	p
Time of onset (min)	18.3±2.9 (12-23)	17±3.3 (10-21)	2.653	0.013
Duration of analgesia (min)	418±48.9 (250-475)	464±45.5 (300-550)	2.836	0.010

Data are presented as mean±SD, ranges are in parenthesis.

Augmentation of progress of labor, using oxytocin infusion (5 IU/500 ml glucose 5%) was required in 66 parturient (31.8%) in ROP group and in 62 parturient (29.9%) in DEX group with a non-significant difference between both groups, (X^2=0.383, p>0.05). Also, mean FHR showed a non-significant difference between both groups (F=1.320, p>0.05). Forty nine parturient developed spontaneous rupture of membranes (SROM); 21 (10.1%) in ROP group and 28 (13.5%) in DEX group with a non-significant difference between both groups, (X^2=0.249, p>0.05). Time till occurrence of SROM showed non-significant difference among studied parturient. Twenty parturient; 8 (3.8%) in ROP and 12 (5.7%) in DEX group had light meconium stained liquor with a non-significant difference between both groups, (X^2=0.4, P>0.05), (Table 4).

Table (4): Labor data

Parameter		ROP group	DEX group
Need for augmentation		66 (31.8%)	62 (29.9%)
FHR (beat/min)		130.1±2.8	129.5±1.6
SROM	Frequency (%)	21 (10.1%)	28 (13.5%)
	Time of occurrence (min)	246 ±19.5	215.5±28.9
Light meconium stained liquor		8 (3.8%)	12 (5.7%)

Data are presented as mean±SD & numbers, percentages are in parenthesis
SROM: Spontaneous rupture of membranes CS: caesarean section

Three hundred eighty five parturient had spontaneous vaginal delivery and 29 had caesarean section. Mean duration of 1st and 2nd stages of labor and total

duration of labor were non-significantly shorter in DEX group compared to ROP group. All of the 385 parturient had vaginal delivery required episiotomy; all of these episiotomies were performed without perineal infiltration of local anaesthesia. Evaluation of postpartum perineal pain sensation showed a significantly lower pain scores in DEX group (F=7.637, p=0.001) with significantly higher frequency of patients with low pain scores (X^2=3.968, p<0.05) and significantly lower frequency of patients requested analgesia for episiotomy related pain (X^2=3.149, p<0.05), (Table 5).

Table (5): Delivery and postpartum data

			ROP group	DEX group
Mode of delivery	Vaginal delivery		162 (78.2%)	169 (81.6%)
	CS		45 (21.7%)	52 (18.4%)
Duration of labor (min)	1st stage		451.1±94.1	400.2±126
	2nd stage		74.6±7.5	50.1±8
	Total duration (min)		525.7±92.2	450.3±130.4
Post-episiotomy pain data	Score	0	67 (32.4%)	92 (44.4%)
		1	76 (36.7%)	78 (37.6%)
		2	64 (30.9%)	37 (18%)
	Mean score		2±0.8	1.7±0.7
Postpartum bleeding	Frequency		8 (3.8%)	13 (6.3%)
	Atonic		8 (3.8%)	12 (5.8%)
	Traumatic (cervical tear)		0	1 (0.48%)

Data are presented as mean±SD & numbers, percentages are in parenthesis.

During postpartum follow-up, 21 patients had postpartum bleeding with non-significant difference between both groups. In 20 patients bleeding was atonic in nature and was controlled conservatively and the 21st had traumatic postpartum haemorrhage (anterior cervical tear) that repaired and bleeding was controlled. No patient required blood transfusion for compensation, (Table 5).

Discussion

The present study relied on single caudal injection of ropivacaine alone or in combination with dexamethasone for labor analgesia and such policy was previously applied using single epidural injection for provision of analgesia by ***Li et al.*** [13], who investigated the effect of ropivacaine in combination with fentanyl for labor pain versus no epidural analgesia, and by ***Khafagy et al.*** [14] who evaluated the efficacy of adding dexamethasone versus fentanyl to epidural bupivacaine on postoperative analgesia and reported significantly prolonged time to first analgesic requirement by 5.2 and 4.8 times in fentanyl and dexamethasone groups compared to bupivacaine alone with significant reduction in postoperative meperidine consumption during the first 24 h in the fentanyl and dexamethasone groups by 65 and 62.5% respectively in comparison bupivacaine alone.

Caudal ropivacaine in dose of 0.15% provided manifest sensory blockade in both groups and only 10% of studied women had slight lower limb weakness without limiting the ability to move. Moreover, there were non-significant changes of hemodynamic variable throughout the duration of caudal block in comparison to baseline measures.

These findings go in hand with previous studies evaluated the analgesic efficacy of neuroaxial ropivacaine and support the used ropivacaine concentration; ***Sitsen et al.*** [15] compared ropivacaine 0.2%, 0.125% and levobupivacaine 0.125% in addition to sufentanil 1 µg/ml for postoperative epidural pain relief and reported that all the three solutions provided adequate analgesia and minimal motor block and the higher concentration of ropivacaine 0.2% was associated with a higher consumption of local anesthetic and did not result in a decrease in the consumption of sufentanil. ***Wang et al.*** [16] found both thoracic epidural 0.15% and 0.2% ropivacaine provide effective postoperative pain control in combination with fentanyl without motor block and 0.15% ropivacaine is preferable considering the lower incidence of adverse events. ***Inoue et al.*** [17] compared PCEA using 0.2% ropivacaine and 12.5 mg/ml or 25 mg/ml morphine and found both provide equianalgesia with no differences in bolus administration, but with respect to the analgesic efficacy and the potential risk for side effects, PCEA using 0.2% ropivacaine and 12.5 mg/ml morphine is a better choice for postoperative gynaecological patients.

Sensory blockade data showed a superior analgesic effect of ropivacaine/ dexamethasone mixture manifested as significantly earlier onset of analgesia in association with significantly prolonged duration of analgesia. These findings are in line with the limited previous studies evaluated the outcome of regional administration of dexamethasone; ***Thomas & Beevi***, [18] found preoperative epidural administration of dexamethasone 5 mg, with or without bupivacaine, reduces postoperative pain and morphine consumption following laparoscopic cholecystectomy. ***Bigat et al.*** [19] investigated the anesthetic and analgesic effectiveness of adding dexamethasone to lidocaine for intravenous regional anesthesia (IVRA) and reported that patients received combination of lidocaine and dexamethasone reported significantly lower pain scores and required less acetaminophen in the first 24 h after surgery and concluded that the addition of 8 mg dexamethasone to lidocaine for IVRA in patients undergoing hand surgery improves postoperative analgesia during the first postoperative day. ***Shrestha et al.*** [20] found dexamethasone with local anaesthetic prolongs postoperative analgesia significantly than tramadol WHEN used as admixture to local anesthetic in brachial plexus block in upper extremity surgery.

Also, ***Khafagy et al.*** [14] found epidural bupivacaine-dexamethasone admixture had almost the same analgesic potency as bupivacaine-fentanyl with opioid-sparing and antiemetic effects. ***Parrington et al.*** [9] and ***Vieira et al.*** [21] found the addition of dexamethasone to mepivacaine or bupivacaine-epinephrine-clonidine, respectively, prolongs the duration of sensory block and reduces opioid use after supraclavicular or interscalene block, respectively.

The applied policy for labor analgesia did not interrupt labor progression or induce or increase the frequency of labor-related complications. Moreover, the reported frequency of cesarean section (7%) was reasonable and was superior to that reported by ***Bakhamees & Hegazy,***

[22] who reported a frequency of cesarean section of 12.3% and 4.7% in nullipara received epidural analgesia or not, respectively, for labor pain and concluded that epidural analgesia is an effective method of pain relief during labor compared to the other analgesic methods of labor pain relief, and it does not increase the incidence of cesarean section deliveries.

Furthermore, caudal analgesia provided additional advantage; considering episiotomy was mandatory for primigravida giving birth vaginally especially if instrumental aid was required, caudal analgesia facilitated episiotomy repair spared the need for local anesthesia infiltration and reduced consumption of post-episiotomy repair analgesia. Moreover, such effect was more evident in DEX group that showed significantly longer duration of analgesia and significantly lower frequency of prerequisite for rescue analgesia.

Multiple studies tried to investigate the analgesic effect of dexamethasone; ***Ma et al.*** [23]found in-vitro pretreatment of neuroblastoma cells with dexamethasone significantly attenuated bupivacaine- and lidocaine-induced cell injury, prevented the decline of mitochondrial potential caused by bupivacaine and increased the levels of Akt phosphorylation and suggested that dexamethasone exerts a cytoprotective effect against bupivacaine-induced neuronal cell injury possibly through mechanisms involving activation of the Akt signaling pathway. Another possible mechanism is abolishment or suppression of inflammatory cytokine release with its subsequent nociceptive effects, in line with this assumption, ***Wang et al.*** [24]**,** found epidural dexamethasone as adjuvant to epidural analgesia, prevented elevation of maternal temperature and prevented increased serum levels of interleukin-6, one of the potent inflammatory cytokines, compared to control parturient received epidural analgesia free of dexamethasone.

It could be concluded that caudal ropivacaine/dexamethasone provided safe profound labor analgesia without interruption of progress of labor and spared the need for perineal anesthesia for episiotomy repair and minimized the need for subsequent analgesia.

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