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Research Article

Extending labor epidural analgesia using lidocaine plus either dexmedetomidine or epinephrine for emergency cesarean section

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KEYWORDS

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Abstract *Objective:* We designed this study to test whether dexmedetomidine 1 μg/kg can be an alternative to epinephrine 5 μg/ml (1/200.000) as an adjuvant to lidocaine 2% for fastening the extension of labor epidural analgesia into an adequate block for emergency cesarean section (CS).
Methods: Sixty patients having epidural analgesia for normal delivery who required emergency CS were assigned to either lidocaine–epinephrine (LE) group ($n = 30$) received 19 ml of lidocaine 2% and 1 ml containing 5 μg epinephrine or lidocaine–dexmedetomidine (LD) group ($n = 30$) received 19 ml of lidocaine 2% and 1 ml containing 1 μg/kg dexmedetomidine. If the patient feels any discomfort (VAS >3) during surgery, intravenous fentanyl 25–50 μg was given. Sedation level was assessed using five points numerical scale.
Results: Both groups were comparable regarding the onset time and time to maximum block height, p value >0.05. The number of patients required intraoperative fentanyl was higher in LE group compared to LD group, p value <0.05. The mean total fentanyl supplementation was more in LE group compared to LD group, p value <0.001. Overall sedation score was higher in LD group than in LE group (p value <0.001), and more patients had bradycardia in LD group compared to LE group (p value <0.001). The mean time to two segment regression, mean time to regression to Bromage 0 and mean time to first analgesic requirement were significantly longer in LD group compared to LE group, p value <0.001.
Conclusion: Epidural dexmedetomidine is comparable to epinephrine as an adjuvant to epidural lidocaine in fastening the onset of surgical anesthesia and resulted in better intraoperative analgesia and in longer duration of sensory and motor block in the settings of converting labor epidural analgesia for emergency CS.

1. Introduction

Epidural analgesia is commonly used to provide pain relief during labor. To extend the epidural analgesia in labor for

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emergency cesarean section (CS), a fast onset solution of local anesthetic is required aiming to achieve rapid and good quality of epidural anesthesia. Different solutions of local anesthetics are used for this reason. The optimum choice of local anesthetic solution for achieving rapid and reliable epidural anesthesia for CS is still not clarified [1]. The solution used is selected according to local policies.

Addition of other drugs to the local anesthetic as adrenaline, bicarbonate and fentanyl has been described [2–4].

Hillyard et al. [5] reported in meta-analysis that the combination of 2% lidocaine with epinephrine for epidural top-up provided the fastest onset of surgical anesthesia.

Dexmedetomidine is α-2 adrenergic agonist with analgesic properties that augment local anesthetic effects when given by epidural route [6,7]. It was demonstrated that dexmedetomidine enhances the local anesthetic action of lidocaine either by causing vasoconstriction around the site of injection delaying lidocaine absorption and hence prolonging its action or by causing direct inhibition of the peripheral neuronal activity [8].

This study was designed to test whether dexmedetomidine 1 μg/kg can be an alternative to epinephrine 5 μg/ml (1/200.000) as an adjuvant to lidocaine 2% for speeding the onset to fasten the extension of epidural analgesia into an adequate block for emergency CS in patients having epidural analgesia for normal delivery who required CS.

Our primary outcome was the time for T4 loss of sensation to cold (onset time). Secondary outcomes were maximum block height, block duration, need for intravenous fentanyl supplementations, side effects, and neonatal outcomes.

2. Materials and methods

After obtaining institutional ethical approval, an informed written consent was signed by each patient included in the study; mothers were instructed and agreed not to breast-feed their babies for 24 h. Sixty patients between 20 and 40 years old, American Society of Anesthesiology (ASA) I–II, were included in the study at Saad Specialist Hospital, Alkhobar, Saudi Arabia, in the period between January 2014 and July 2015. Inclusion criteria were as follows: emergency CS in the absence of maternal or fetal compromise (category 2, 3) (Table 1) [9], well-functioning epidural catheter (required 2 or less intra-partum supplementation with bupivacaine 0.125%), and uncomplicated pregnancy with singleton pregnancy $\geqslant$36 weeks of gestation. Exclusion criteria included emergency CS with maternal or fetal compromise (category 1) (Table 1) [9], a poorly functioning epidural catheter during the labor, if narcotics or alpha 2 agonists rather than our regimen was given within the previous 4 h, last intrapartum supplementation of epidural catheter less than 2 h and if the parturient had pre-eclampsia or eclampsia, bleeding, liver impairment, renal impairment, diabetes mellitus or cardiac disease.

The routine method used for epidural labor analgesia in our hospital is the administration of a bolus of 10 ml 0.125% bupivacaine with 50 μg fentanyl followed by a continuous infusion at a constant rate (10–12 ml/h) of 0.125% bupivacaine with 2 μg/ml fentanyl. An additional bolus of 5 ml 0.125% bupivacaine was supplemented when required aiming to have adequate analgesia for labor up to T10 level.

Patients were randomly assigned by computer-generated random numbers using sealed envelopes to one of two groups. Group lidocaine–epinephrine (LE) (n = 30) received 19 ml of lidocaine 2% and 1 ml containing 5 μg (1:200.000) epinephrine ((Daihan Pharm Co., Seoul, Korea) and group lidocaine–dexmedetomidine (LD) (n = 30) received 19 ml of lidocaine and 1 ml containing 1 μg/kg dexmedetomidine (Precedex®, Hospira, Lake Forest, IL, USA). Both solutions were identical and labeled as test medication and freshly prepared by a pharmacist not involved in the study who allocated the patients according to the number in the sealed envelope. The solution was injected over 5 min using stopwatch (4 ml/min) through epidural catheter after negative aspiration to both blood and CSF.

To convert the epidural analgesia to epidural anesthesia for emergency CS patients were shifted to the operating room, and electrocardiography, pulse oximetry, and non-invasive blood pressure monitoring were applied. An intravenous infusion of 500 ml Lactated Ringer's solution started. The patient was positioned in the supine position with a left lateral tilt using a wedge. Baseline blood pressure and heart rate were recorded, immediately before the top-up, assessment of both the sensory level (cold) and the degree of motor block (modified Bromage scale score [10]: 0, patient can raise extended leg; 1, can bend knees; 2, can bend ankles; 3, unable to bend knees or ankles).

After injecting the study medication the block was assessed every 2 min. Sensory block was assessed in both sides in the midclavicular line using ice (cold sensation) and motor block assessed by using modified Bromage Scale.

The highest sensory level was recorded; time to highest sensory level and time from skin incision to delivery were recorded.

Systolic blood pressure (SBP) and heart rate (HR) were measured every 2 min, ephedrine 5 mg boluses were given if SBP dropped $<$100 mmHg or $>$20% from baseline and repeated every 5 min if needed, and atropine 0.5 mg boluses were given iv if the HR was less than 55 beats/min and repeated after 5 min if needed (maximum 2 mg).

If the patient had any discomfort during surgery (VAS $>$ 3), analgesic supplementation was provided by

Table 1 Categorization of urgency of cesarean section [9].

	Grade definition done at time of decision to operate
Category 1	Immediate threat to life of mother or fetus as active bleeding, placental Abruption, uterine rupture, severe fetal distress
Category 2	Maternal or fetal compromise but not immediately life-threatening
Category 3	Need early delivery but no maternal or fetal compromise (a parturient who has booked for an elective cesarean section but goes into labor before her scheduled operation date)
Category 4	At a time that suits the patient and maternity team