

ORIGINAL ARTICLE

## Intrathecal dexmedetomidine's effect on the requirement of dose of hyperbaric bupivacaine in spinal anesthesia in the caesarean section patients

Poonam M Vaghela<sup>1</sup>, Arpit J Gohel<sup>2</sup>

<sup>1</sup> Assistant professor, GMERS Medical college, Gandhinagar

<sup>2</sup> Department of Pathology, GCS Hospital Ahmedabad

### ABSTRACT

**BACKGROUND AND OBJECTIVES:** Regional anaesthesia has become more popular in caesarean deliveries because most of the parturients prefer being awake during child birth. In addition it is a safer method than general anaesthesia. Present study was done with an aim to determine the ED95 of intrathecal hyperbaric bupivacaine with or without Dex as an adjuvant in spinal anaesthesia for caesarean section using an improved up-down sequential allocation method. **METHODS:** A total of 90 participants were included in the study. All the participants were of physical class I or II. All the participants were enrolled for elective caesarean section. They were equally divided into two groups. The study solution for the two groups was 0.75% hyperbaric bupivacaine mixed with 5 mcg of Dex (Dex Group) or saline (Control Group) and was diluted to 3 mL with saline. A volume not greater than 1 mL was extracted using an insulin syringe (1 ml). The primary outcome of this study was successful anaesthesia or unsuccessful anaesthesia. The secondary outcomes of this study were the characteristics of spinal anaesthesia, analgesic duration of spinal anaesthesia and side-effects. **RESULTS** There was a significant difference in the duration of the sensory block between the Dex group and the Control group. The total requirement of postoperative rescued sufentanil during the first 24 h in the Dex group was less than in the Control. There was no significant difference in the patient satisfaction of analgesia between the two groups ( $P>0.05$ ). **CONCLUSION:** Intrathecal 5 mcg dexmedetomidine potentiated hyperbaric bupivacaine antinociception by 31% in spinal anaesthesia for patients undergoing caesarean section and prolonged the spinal analgesia duration without additional side effects.

**Keywords:** Bupivacaine. Caesarean. regional anaesthesia. Spinal anaesthesia

### INTRODUCTION

In caesarean births, incisions are made on the abdomen and uterus to deliver the baby. Rates of caesarean section are on the rise around the world, a report from the World Health Organization (WHO) noted a yearly incidence of 18.5 million caesarean sections worldwide.<sup>1</sup> A recent study compared data on births collected at two time points within a four-year interval from healthcare facilities across 21 countries, and identified a 5% global increase in caesarean sections.<sup>2</sup>

This figure is expected to continue increasing over the coming years. The practice of regional anaesthesia for caesarean section is common place today in developed countries like the USA and the UK, and is gradually increasing in developing countries. Regional anaesthesia has become more popular in caesarean deliveries because most of the parturients prefer being awake during child birth. In addition it is a safer method than general anaesthesia. Subarachnoid block is the most convenient and safe anaesthesia during caesarean section.<sup>3</sup> Subarachnoid block (SAB) is the anaesthesia technique of choice and is the gold standard for caesarean section because of the ease, effectiveness as well as the rapidity in establishing adequate levels of analgesia. In addition, the small amounts of local anaesthetics (LA) administered make

### \*Corresponding Author:

Dr. Arpit J. Gohel,  
A-504, Vande mataram icon,  
New S.G. Road, Gota,  
Ahmedabad-382481  
Email:- arpit.gohel@gmail.com

placental transfer and foetal uptake of drug negligible compared to other regional techniques.<sup>4</sup> Dexmedetomidine is a highly selective  $\alpha_2$  receptor agonist ( $\alpha_2$ -AR), which has sedative, analgesic, and antisympathetic pharmacological effects and unique conscious sedation without respiratory depression. Currently, dexmedetomidine is widely used in patients in clinics and in clinical anaesthesia.<sup>5</sup> Dexmedetomidine is considered as a modern approach for comfortable anaesthesia. Experiments in pregnant rats have shown that dexmedetomidine has no adverse effects. Additionally, dexmedetomidine has been successfully applied as anaesthesia in preterm infants, infants, and children, as well as in patients who have caesarean section. Placental transfer and foetal metabolism of dexmedetomidine have been reported<sup>4</sup>, and there are no adverse effects on neonates. However, placental transfer of dexmedetomidine in intravertebral anaesthesia area has rarely been studied.<sup>5</sup> Bupivacaine, an amide type of LA was introduced by Ekenstam in 1957 and first used clinically by Telivuo in 1963.<sup>3</sup> It is the most commonly employed LA intrathecally for caesarean section. It is well known that the dose of the drug influences the duration of sensory as well as motor blockade and has a significant effect on the degree of hypotension.<sup>4</sup> However, intrathecal Bupivacaine alone may be insufficient to provide complete analgesia despite high sensory block. 13% of the patients undergoing caesarean delivery had visceral pain even after the intrathecal administration of 15 mg of Bupivacaine.<sup>6</sup> Many mothers require supplemental analgesics to relieve pain associated with exteriorization of the uterus and traction on the abdominal viscera.<sup>7</sup> We hypothesized that intrathecal Dex could reduce the value of ED<sub>95</sub> (95% effective dose) of spinal hyperbaric bupivacaine. In this study, we aimed to determine the ED<sub>95</sub> of intrathecal hyperbaric bupivacaine with or without Dex as an adjuvant in spinal anaesthesia

for caesarean section using an improved up-down sequential allocation method.

## **MATERIALS AND METHODS**

All the participants were informed about the study. The methodology and the aim of the study were explained to them. The written informed consent was obtained from of the participants. A total of 90 participants were included in the study. All the participants were of physical class I or II. All the participants were enrolled for elective caesarean section. Exclusion criteria included the following: gestational age less than 36 weeks, active or early labour, ruptured membranes, patients' body mass index (BMI) > 35 kg/m<sup>2</sup>, hypertension or pre-eclampsia, diabetes or gestational diabetes, intrauterine growth restriction, any contraindications to regional anaesthesia and history of more than one previous caesarean delivery. A total of ninety participants were included in the study. They were equally divided into two groups. Group A consisted of 45 participants and were assigned as group, where as the rest 45 were assigned to control group. The study solution was prepared under sterile conditions. The CSEA technique was performed by two attending anaesthesiologists. The study solution for the two groups was 0.75% hyperbaric bupivacaine mixed with 5 mcg of Dex (Dex Group ) or saline (Control Group) and was diluted to 3 mL with saline. A volume not greater than 1 mL was extracted using an insulin syringe (1 ml). The primary outcome of this study was successful anaesthesia or unsuccessful anaesthesia. The secondary outcomes of this study were the characteristics of spinal anaesthesia, analgesic duration of spinal anaesthesia and side-effects. Demographic data, duration of surgery, onset time to T<sub>10</sub>, onset time to the motor block, onset time to the highest block level and duration of the sensory block and analgesia were described as the mean  $\pm$  SD and tested with Student's *t* test.

**RESULT AND DISCUSSION**

This clinical trial was for period of one year. During this period, 96 parturients were involved and assessed for suitability for this clinical trial. Finally, 90 parturients were enrolled and allocated to the two groups. None of the 90 parturients was lost in the final analysis. There was no significant difference in demographic data, obstetric data or duration of surgery between the two groups (Table 1).

**Table 1: demographic data of the participants**

Characteristics	Dex group	Control group	P Value
Age	27 ± 2	26 ± 1	0.34
Height	162 ± 2	160 ± 2	0.40
Weight	72 ± 4	70 ± 1	0.82
Gestational age	40 ± 2	40 ± 2	0.56
Duration of surgery	45 ± 6	47 ± 6	0.40

Characteristics and efficacy of spinal anesthesia in patients with “effective anesthesia” are presented in Table 2. The onset time was similar in the two groups. The onset time to motor block was also similar in the two groups. There was no significant difference in the highest block level between the two groups, and the time to the highest block level was also same. There was a significant difference in the duration of the sensory block between the Dex group and the Control group. The duration until patients required their first postoperative analgesic was longer in the Dex group than in the Control group. The total requirement of postoperative rescued sufentanil during the first 24 h in the Dex group was less than in the Control. There was no significant difference in the patient satisfaction of analgesia between the two groups ( $P>0.05$ ). In the current study, we chose 5 mcg Dex as an IT adjuvant of bupivacaine based on several previous studies in which authors reported that IT 5 mcg Dex can extend the duration of spinal analgesia without any additional side effects. Considering that a caesarean

section is a swift procedure, and according to our previous study, we defined effective anaesthesia as a bilateral T<sub>5</sub> or above sensory block level achieved within 10 min of IT drug administration with no additional epidural anaesthetic required for intraoperative pain. We found that the ED<sub>95</sub> of bupivacaine was 8.4 mg in the Dex group and 12.1 mg in the Control group. IT 5 mcg Dex can decrease the ED<sub>95</sub> of IT hyperbaric bupivacaine by 31% in parturients undergoing caesarean section.

**Table 2: Characteristics of spinal anaesthesia in patients with effective anaesthesia**

	Dex group	Control group	P Value
<b>Sensory block</b>			
Highest level of block	T5	T5	0.05
Onset time to T10	3.4 ± 1	3.5 ± 1	> 0.05
Duration	110 ± 34	66 ± 30	< 0.05
<b>Motor block</b>			
Duration of analgesia	224 ± 44	156.7 ± 30	< 0.001
Onset time to T10	3.5 ± 1	3.3 ± 2	0.001
Consumption of sufentanil	47 ± 8	64.5 ± 10	< 0.05

We demonstrated that the duration of sensory block and analgesia were prolonged and the consumption of rescued sufentanil was reduced by IT 5 mcg Dex. Dexmedetomidine, a highly selective, alpha-2-adrenergic receptor ( $\alpha_2$ -AR) agonist, has been popularly used by anaesthetists in various anaesthetic techniques due to its haemodynamic-stabilizing properties and sedative, analgesic, and sympatholytic effects.<sup>8</sup> There were several studies concerning the safety of Dex as an adjuvant in spinal anaesthesia. A preclinical study demonstrated that adding Dex to ropivacaine extends the duration of the sensory blockade but showed no neurotoxicity, even at a high-dose of 20 µg/kg of Dex administered with ropivacaine in sciatic nerve blocks in rats.<sup>9</sup>

In our clinical practice, no reports suggested any neurological deficit associated with intrathecal Dex. No abnormal symptoms or signs in the nervous system were found, which suggest that Dex is a safe intrathecal adjuvant. Side effects between the two groups were similar in this study.

### **CONCLUSION**

Intrathecal 5mcg dexmedetomidine potentiated hyperbaric bupivacaine antinociception by 31% in spinal anaesthesia for patients undergoing caesarean section and prolonged the spinal analgesia duration without additional side effects.

### **REFERENCES**

1. Petrou S, Khan K: An overview of the health economic implications of elective caesarean section. *Applied health economics and health policy* 2013, 11:561-76.
2. Zeitlin J, Manktelow BN, Piedvache A, Cuttini M, Boyle E, Van Heijst A, Gadzinowski J, Van Reempts P, Huusom L, Weber T: Use of evidence based practices to improve survival without severe morbidity for very preterm infants: results from the EPICE population based cohort. *bmj* 2016, 354:i2976.
3. Buckenmaier CC, Bleckner LL: Anaesthetic agents for advanced regional anaesthesia. *Drugs* 2005, 65:745-59.
4. Jutkowitz A: Cardiopulmonary Cerebral Resuscitation: Guidelines and Applications. Kansas City Convention Center Kansas City, MO August 17-20, 2018, 2018. p. 36.
5. Shrestha K, Shen WI: Use Of Dexmedetomidine In General Anesthesia And Other Procedures.
6. Gadsden J, Hart S, Santos AC: Post-caesarean delivery analgesia. *Anesthesia & Analgesia* 2005, 101:S62-S9.
7. Sun Y, Xu Y, Wang G-N: Comparative evaluation of intrathecal bupivacaine alone, bupivacaine-fentanyl, and bupivacaine-dexmedetomidine in caesarean section. *Drug research* 2015, 65:468-72.
8. Saikia A, Bora D, Das A, Tiwari PK: Onset and Duration of Sensory and Motor Blockade of Bupivacaine Supplemented with Clonidine and Dexmedetomidine Administered Intrathecally–A Clinical Comparative Study. *Journal of Contemporary Medical Research* 2016, 3:1906-8.
9. Xiao F, Liu L, Xu W, Zhang Y, Wang L: Dexmedetomidine can extend the duration of analgesia of levobupivacaine in transversus abdominis plane block: a prospective randomized controlled trial. *Int J Clin Exp Med* 2017, 10:14954-60.