

EVALUATION OF INTRATHECAL DEXMEDETOMIDINE ADDED TO BUPIVACAINE FOR LABOR ANALGESIA.

Anaesthesiology

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ABSTRACT

Background And Aims: The aim of this study was to evaluate the effectiveness of intrathecal dexmedetomidine with bupivacaine for labor analgesia by assessment of onset, duration and quality of analgesia and neonatal outcomes. **Method:** In this study 40 eligible parturient who received dexmedetomidine 5 µg and heavy bupivacaine 0.5% 2.5 mg diluted upto 2.5 cc with sterile NS intrathecally for labor analgesia were selected. The time of onset, duration and quality of analgesia were noted. Maternal parameters pulse rate, systolic blood pressure, motor block and side effects of pruritus, nausea, vomiting, hypotension and headache were recorded. Neonatal outcomes in terms of mode of delivery and APGAR score were noted. If VAS >3, analgesia was supplemented with epidural bupivacaine 0.125% 10 ml during labor. For rescue analgesia, Inj. Tramadol 1 – 2 mg/kg iv was given as per institutional protocol if the patient VAS score was still more than 3 even after second dose of epidural. **Result:** Mean time for onset of analgesia was 2 minutes (VAS<3). All parturient had VAS < 3 throughout the labor. Mean duration of Labor was 99.4 ± 48.35 min. Total duration of labor ranges from 45 minutes to 210 minutes in our study. Most 92.5% of parturient had maximum motor blockade of grade 1 and it was lasted maximum upto 30 min. Hypotension was observed in two parturient and one parturient had nausea, which responded to conservative management. The mean APGAR score at 1 min was 8.85 ± 0.97 and at 5 min it was 10 (excluding LSCS delivery). Out of 40 total, 30 parturient have graded labor analgesia as excellent and rest have graded as good. **Conclusion:** Dexmedetomidine (5µg) seems to be a safe and efficacious adjuvant to intrathecal bupivacaine 0.5% (2.5 mg) in women undergoing vaginal delivery. This may be helpful for parturient coming late to the delivery room, seeking rapid onset with good quality of analgesia.

KEYWORDS

Dexmedetomidine, Bupivacaine, Labor analgesia.

INTRODUCTION

'The delivery of the infant into the arms of a conscious and pain-free mother is one of the most exciting and rewarding moment in medicine' Moir.^[1]

Labour pain not only steal the pleasure of unique experience of childbirth, it may also have harmful effects on the mother and baby, as pain stimulates catecholamine release, which constricts the uterine blood vessels and limits placental perfusion. Labor pain also causes maternal hyperventilation leading to hypocarbia, which further constricts the uterine vessels and decreases the mother's ventilatory drive between contractions, thus causing the maternal oxygen dissociation curve to shift towards left. These factors compromise oxygen supply to the foetus and can lead to foetal hypoxaemia and foetal metabolic acidosis. Premature 'bearing down' urged due to labour pain can also lead to birth canal trauma and birth injury. To avoid all these adverse effects of labor pain, it is our duty to provide labor analgesia to all parturients. A good labour analgesia should aim not only to relieve the pain and suffering of the mother but also to decrease foetal acidosis and make the delivery process safer for both the mother and baby.

The utilization of epidural services were widely used to provide pain-free labour and considered the gold standard in many parts of the world. It has advantage of providing flexibility to meet the needs of each patient^[2]. Recently, Intrathecal route is also gaining popularity to provide analgesia during labor as it has advantages in the form of simplicity of technique include the rapidity of onset and reliability, with minimal hemodynamic changes and motor block. The use of single-shot intrathecal low dose bupivacaine for labour analgesia has been demonstrated and found to be effective^[3]. Several adjuncts have been added to intrathecal bupivacaine to prolong the duration of sensory block. Such adjuncts include fentanyl, sufentanil, morphine, clonidine, and dexmedetomidine.

Dexmedetomidine (DMT), a new highly selective alpha 2 - agonist, is evaluated as a neuraxial adjuvant in spinal anaesthesia and it provides stable haemodynamic conditions, good quality of intraoperative, and prolonged postoperative analgesia with minimal side effects^[4]. Literature also says that dexmedetomidine provides prolonged labour analgesia when used as an adjuvant.

MATERIAL AND METHOD

This prospective observational study was conducted at labour room in tertiary care hospital of South Gujarat during 2021- 2022. Patients who

received labor analgesia with intra thecal hyperbaric bupivacaine (0.5%) 2.5 mg, dexmedetomidine 5µg (total volume 2.5ml prepared by addition of normal saline) were eligible candidates for our study. Inclusion criteria was both primigravida and multigravida parturients between age 18 to 40 years belonging to ASA class I, II and III physical status who were in active phase of labor with cervical dilatation 3-4 cm with cephalic singleton pregnancy and vertex presentation and willing to participate in study. Parturients with complicated obstetric history, associated medical illness, allergy to study drug or infection at local site were excluded. The study was conducted after taking written and informed consent for study participation. Before providing labor analgesia, detailed pre anaesthetic evaluation was carried out. Obstetric examination was carried out by on duty obstetric resident in form of per-abdomen examination for presentation and position of foetus.

Intravenous access is secured & preloading with 500 ml of ringer lactate was done. After explaining the procedure, pre procedure pulse rate, blood pressure, VAS score, fetal heart rate & obstetrics parameter like cervical dilation, station, effacement were noted. Under aseptic precautions, with parturient in left lateral position using 18 gauge Tuohy needle, epidural catheter was inserted.

After epidural catheter insertion, intrathecal space was located one space below epidural catheter insertion, by 25 G spinal needle & 1st analgesia dose with hyperbaric bupivacaine (0.5%) 2.5 mg, dexmedetomidine 5µg (total volume 2.5ml prepared by addition of normal saline) was given. After that epidural catheter was fixed to back & patient was turned supine.

Analgesia was assessed by asking parturient about pain & using VAS score (0=no pain, 10= worst pain). If patient complaint of pain & VAS >3 even after 10 minutes of intrathecal analgesia then it was considered as a failed case. After that analgesia was supplemented with Epidural dose of 10 ml 0.125% bupivacaine after confirming the right placement of epidural catheter with test dose of Inj. Lignocaine with adrenaline 2% 2ml. This was repeated as & when VAS >3 again. After second dose of epidural if the patient VAS score was still more than 3, then a rescue analgesia with Inj. Tramadol 1 – 2 mg/kg iv was given as per institutional protocol.

Modified Bromage scale was used to assess motor blockage Grade 0 = free movement of leg & feet, Grade 1= Just able to flex knee with free movement of feet, Grade 2= unable to flex knee but with free movement of feet and Grade 3= unable to move limb.

Maternal haemodynamic parameters, motor Block by modified bromage scale, SpO₂, extend of sensory block by pinprick method for every 10 min upto half an hour & then every half hourly till delivery of baby were recorded.

Duration of labor, mode of delivery, APGAR score of baby was noted. Patient satisfaction were assessed just after delivery by Grade 1=Fair, Grade 2=Good & Grade 3=Excellent.

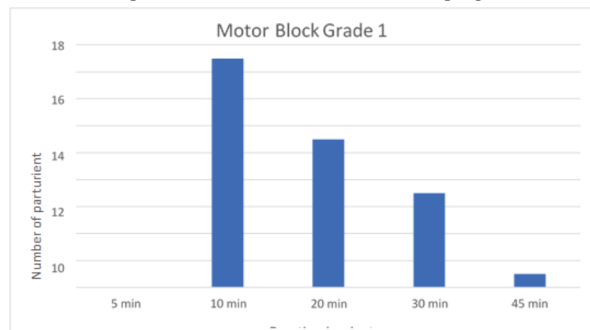
All the patients were followed up for side effects of labor analgesia upto 24 hours after delivery as per departmental protocol.

OBSERVATION AND RESULTS

In our study majority of the parturients were between 21-25 years of age. The youngest parturient was 18 years old and the oldest one was 32 years old. There were 29 multigravida and 11 primigravida parturients.

Onset of analgesia (VAS<3) was achieved within 5 minute of intrathecal injection in all the parturients. Mean time for onset of analgesia was 2 minute (VAS<3). Total duration of labor ranges from 45 minutes to 210 minutes in our study. Mean duration of Labor was 99.4 ± 48.35 min. All the parturients had sufficient analgesia throughout the labor. None of the parturient required epidural supplementation /rescue analgesia during labor.

Most 92.5% of parturient had maximum motor blockade of grade 1. Rest 7.5% of parturient had motor blockade grade 0. None of the parturient had motor blockade of grade 2 and 3. In most of the parturient motor blockade recovered within 30 minutes except in one parturient it lasted till 45 minutes, however in this parturient labor duration was upto 210 minutes. So it didn't affect the progress of labor.



Graph 1: Duration of Motor Block Grade 1

The sensory effect was also monitored along with motor effect. Sensory blockade was achieved upto T8 level in 28 parturient, upto T10 level achieved in 11 parturient. In one parturient sensory blockade upto T6 level was observed. SpO₂ did not fall below 97% in any patient throughout the study period. Fetal heart rate was monitored till the delivery of baby by anaesthesia resident or on duty obstetric resident by stethoscope or cardio topographic machine.

We observed no significant fall in pulse rate except at 30 minutes after labor analgesia. None of the parturient had bradycardia after intrathecal dexmedetomidine throughout the study period. We observed that there was significant fall ($p < 0.05$) in mean systolic blood pressure upto 45 minutes but looking clinically mean systolic blood pressure remained within normal range throughout study period.

Out of 40 parturient, 34 (85%) parturient delivered vaginally while one (2.5%) parturient delivered with the help of vacuum and one (2.5%) parturient with the help of forceps. Four parturient (10%) required LSCS. Indication of LSCS for these patients are fetal distress in 2 patients, fetal tachycardia in one patient and MSL (meconium stained liquor) in one patient.

Table 1: Mode of Delivery

Sr no	Mode of delivery	Number
1	Spontaneous	34
2	Instrumental	Forceps
		Vacuum
3	LSCS	4
	Total	40

The mean APGAR score at 1 min was 8.85 ± 0.97 and at 5 min it was 10 (excluding LSCS delivery).

Maternal satisfaction score was recorded after delivery of baby and it was graded as excellent (grade 3) by 30 (83%) parturients and good (grade 2) by 6 (17%) parturients. Not a single parturient graded it as fair (grade 1). This shows the quality of analgesia provided by intrathecal dexmedetomidine.

All the patients were followed up for 24 hours after delivery for complications like pruritus, nausea, vomiting, hypotension and hypoxia. Hypotension was observed in two parturient which responded to bolus of IV Ringer Lactate fluid 100 ml without help of any vasopressor. Nausea were observed in only one parturient which was treated by Inj. Pantaprazole IV.

DISCUSSION

In developing country with busy labor rooms, single dose spinal analgesia with low dose local anaesthetic agent along with various adjuvants has been gaining popularity to address labor pain. It eliminates the limitations of epidural analgesia like need of costly epidural set, requirement of skill for epidural catheter insertion in parturient making it suitable for resource limited setup.

Initially neuraxial opioids were first choice for labor analgesia. However on the other hand, use of intrathecal 2 agonists dexmedetomidine have antinociceptive action for both somatic and visceral pain. They depress the release of C-fibre transmitters and substance P by hyperpolarising the post synaptic dorsal horn neurons^[10]. It decreases intraspinal prostaglandin, glutamate and substance P production and exerts local actions on nerve fibres leading to analgesic and block prolonging effects. Thus, it has a potential to use as adjuvants with local anaesthetic agents for labor analgesia. On reviewing recent literatures, it has shown that even if there is any uteroplacental transfer with the use of dexmedetomidine, it have no effect on APGAR score and doesn't affect the foetal well-being^[11-15].

We observed that all the parturients had pain relief within 2 minutes of labor analgesia. Dexmedetomidine acts on the receptors of the substantia gelatinosa of the dorsal horn of the spinal cord which inhibit the firing of nociceptive neurons stimulated by peripheral A and C fibres^[16,17]. This spinal mechanism of dexmedetomidine along with bupivacaine provides rapid onset of analgesia. Dilesh P.K, Eapen S, Kiran S, Vivek Chopra (2014)^[4] et al compared intrathecal dexmedetomidine & fentanyl in 112 parturients for labor analgesia and observed that onset of analgesia was faster in group D (dexmedetomidine 10 µg) 50.4 ± 16.81 seconds as compared to group F (fentanyl 20 µg) 71.7 ± 27.66 seconds. Gaballah M Khaled, Abdallah I Sabry (2020)^[6] et al studied intrathecal labour analgesia with 2.5 mg bupivacaine + dexamethasone 4 mg along with different adjuvants. They observed that the onset of analgesia was 2.8 ± 0.6 minute in group D (dexmedetomidine 5µg), 2.9 ± 0.8 minute in group F (fentanyl 25 µg), 4.0 ± 0.4 minute in group M (morphine 100 µg) and in 4.4 ± 0.2 minute in group C (normal saline).

In many studies it was observed that the duration of labor analgesia was longer with intrathecal dexmedetomidine compared to other adjuvants. The maximum duration of analgesia was 210 minutes in our study. In different studies duration of labor analgesia with intrathecal 5 g dexmedetomidine ranges from 160.54 52.4 min to 345 ± 20 minutes^[5-8].

In this study most of the parturient had maximum motor blockade of grade 1 and it was recovered within 30 minutes. This shows that, intrathecal administration of bupivacaine and dexmedetomidine for labor analgesia doesn't affect the ambulation of the parturient or maternal efforts during delivery of baby. In our study, a very low dose of intrathecal dexmedetomidine and bupivacaine was used. Higher doses administered neuraxially can impair motor function of parturients^[18]. This can result in higher instrumental delivery and caesarean rates. The motor block observed in our study had regressed completely before the commencement of the second stage of labor. Gaballah M Khaled, Abdallah I Sabry (2020)^[6] also observed similar finding on motor blockade with modified bromage score of 1 at 5 and 15 minutes after the intrathecal injection of dexmedetomidine in mean 0.3 ± 0.4 parturients. Thirty minutes after the intrathecal injection, all the study parturients had modified bromage scale of 0. In none of the study parturients had modified bromage score of 2 or more.

In present study most 85% of the parturients had spontaneous vaginal

delivery. Only 5% were delivered with the help of vacuum/forceps (instrumental delivery). Four patients (10%) were shifted to operation theatre for emergency LSCS. In the study conducted by Sanjay Rathod, Geetika G Syal, Rajeev Sood, Kartik Syal (2021)^[8] et al noted that in group I (dexmedetomidine) 98.3% had normal vaginal delivery, 1.7% had instrumental vaginal delivery and none had caesarean delivery. In another study by Gehui Li, Hao Wang, Xiaofei Qi, Xialoei Huang and Yuntao Li (2021)^[9] et al observed that only 2.78% parturient in group D (dexmedetomidine) had caesarean section.

Quality of analgesia can be defined by onset of analgesia, percentage of pain relief and side effects associated with it. Intrathecal dexmedetomidine produces rapid onset of analgesia with effective pain relief till the delivery of baby.

In our study the mean APGAR score at 1 minute was 8.85 ± 0.97 and at 5 min it was 10. Factors which can affect neonatal outcome during labor are maternal hypotension, maternal hypoxia, uterine tetanus. There are many factors related to mother and baby but to access the effect of intrathecal dexmedetomidine on neonatal outcome we excluded parturients in whom neonatal outcome may be compromised due to associated condition. There was no effect of intrathecal labor analgesia on neonatal outcome in our study. The following studies had similar finding, S. Fyreface- Ogan, O. Gogo Job, and C.E. Enyindah (2012)^[3] et al observed that all the babies had APGAR scores ≥ 7 and ≥ 8 in the first and fifth minutes, respectively. Gehan F.Ezz, Heba M. Fathi, Hussein M. Abd Eldayem (2017)^[7] et al noted that first minute APGAR score was significantly higher in group D (dexmedetomidine) 8.2 ± 0.6 than in the other group B (bupivacaine) 7.8 ± 0.7 , but other neonatal parameters showed no significant difference between the two groups.

Parturients were monitored throughout the labor analgesia and side effects like hypotension, nausea, vomiting, hypoxia, pruritus, hypoxia and respiratory depression were noted. Hypotension was observed in two parturient and nausea was observed in only one parturient which were managed conservatively. The following studies noted the maternal side effects during labor analgesia with various adjuvants, S. Fyreface- Ogan, O. Gogo Job, and C.E. Enyindah (2012)^[3] et al observed two women in group B (bupivacaine), one woman in group BF (fentanyl) and three women in group BD (dexmedetomidine) had mild hypotension that was corrected with fluid administration. Mild bradycardia was also observed in all groups that was transient. Dilesh P.K, Eapen S, Kiran S, Vivek Chopra (2014)^[5] et al compared the maternal side effects between group D (dexmedetomidine) and group F (fentanyl). Hypotension was noted in two patients of group D and one patient in group F. 74% parturient in group F experienced pruritus whereas none of the mother in group D experienced it ($p < 0.001$).

From this study, we can conclude that intrathecal labor analgesia with dexmedetomidine 5 µg and bupivacaine 2.5 mg (total volume 2.5 ml by addition of normal saline),

- Provides rapid analgesia within 5 minutes which lasted for at least 210 minutes.
- Associated with minimal motor block which recovered within 30 minutes.
- Causes minimal haemodynamic changes.
- Gives excellent to good satisfaction to mother with minimal / no side effects.

CONCLUSION

Dexmedetomidine (5 µg) seems to be a safe and efficacious adjuvant to intrathecal bupivacaine 0.5% (2.5 mg) in women undergoing normal vaginal delivery. This may be helpful for parturients coming late to the delivery room, seeking rapid onset with good quality of analgesia.

Implication

This study will be of relevance in low resource economy centres, where availability of equipment, accessories and expertise for instituting epidural analgesia is scarce.

Spinal analgesia is a relatively simple and cost effective procedure that can be used for labor analgesia in place of epidural anaesthesia in low resource settings and centre with busy labor room where limited time is available to provide labor analgesia.

The reliability of spinal block, in terms of achieving satisfactory analgesia within a reasonable time limit and providing adequate analgesia till the end of delivery makes it favourable option when

patient comes relatively late during labor and in multipara with whom rapid progress of labor is expected.

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