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Dr. Preethi HN
Assistant professor, Department of Anaesthesiology, Adichunchanagiri Institute of Medical Sciences, BG Nagara, Karnataka, India

Dr. Ravishankar BM
Consultant Anaesthesiologist, Health and Family welfare Department, Hassan, Karnataka, India

Corresponding Author:
Dr. Ravishankar BM
Consultant Anaesthesiologist, Health and Family welfare Department, Hassan, Karnataka, India

Comparison of adverse effects of epidural volume extension with different volumes of normal saline

Dr. Preethi HN and Dr. Ravishankar BM

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Abstract
Epidural volume extension (EVE) refers to an injection of normal saline through epidural catheter following an intrathecal block. It results in a rapid increase in the sensory level of subarachnoid block. Thus, it has been postulated that EVE may be used as a rescue strategy for an inadequate post-spinal sensory block. Women were randomly distributed into three equal groups: Group A(CSE with no EVE), Group B(CSE followed by EVE using 5ml of normal saline) and Group C (CSE followed by EVE using 7.5ml of normal saline). All group received a fixed dose 7.5mg of 0.5% levo- bupivacaine with 25µg of fentanyl followed by epidural volume extension with 5ml of saline in Group B and 7.5ml of saline in Group C in the epidural space. Epidural space is identified (L3-L4) with 18G Tuohy needle & dural puncture performed using a 25G spinal needle and study drug injected; epidural catheter is inserted 3cm into the epidural space and five minutes after insertion of the epidural catheter, normal saline is administered through it for EVE. Epidural volume extension (5 ml/7.5 ml NS) after intrathecal levobupivacaine (7.5mg)-fentanyl can provide desired level of block for CS when compared to intrathecal levobupivacaine (7.5mg)-fentanyl alone, with no significant side effects.

Keywords: Epidural Volume Extension, Levobupivacaine, Normal Saline

Introduction
The most commonly used drug in subarachnoid block for caesarean section is 0.5% Bupivacaine 10 mg (hyperbaric) [1, 2].One of the disadvantages of subarachnoid block with local anaesthetic alone is the limited duration of anaesthesia and postoperative analgesia [3, 4]. During caesarean delivery, blockade up to T4 dermatome is necessary to avoid maternal discomfort due to omental / visceral manipulation.

Addition of opioids such as fentanyl helps in prolonging post-operative analgesia and also helps in decreasing visceral pain during surgery without affecting motor and sympathetic block. Subarachnoid block is commonly associated with hypotension and attendant decrease in utero-placental perfusion. Incidence of hypotension can be decreased by reducing the volume of local anaesthetic agent, but it carries a risk of inadequate analgesia. Bupivacaine, even though potent in terms of analgesia and relaxation it produces when used intrathecally, has greater potential for cardiac toxicity compared to other local anaesthetics. The potency of levobupivacaine is similar to that of bupivacaine *in vivo*; *in vitro* & human pharmacodynamics studies regarding nerve block have shown that it has low cardiovascular and central nervous system toxicity [5-8]. Dose wise, analgesic effects of the two drugs are comparable. But studies have shown that sensory block by levobupivacaine was more prolonged compared to bupivacaine, with a shorter duration of motor block. Different doses of levobupivacaine have been studied for subarachnoid use in caesarean sections and a dose of 7.5 mg has been shown to be effective [9]. Strategies like changes in tilt of table are used to raise the level of an inadequate sensory block following intrathecal injection in non-obstetric cases, but this is not desirable in obstetric cases [10, 11]. Epidural volume extension (EVE) technique is a modification of combined spinal epidural anesthesia (CSEA), where in an injection of normal saline is made through epidural catheter into epidural space, following an intrathecal block. The epidural saline increases the level of sensory block without altering the intensity of local anaesthetics effect on motor blockade. This technique also allows for reduction in local anesthetic dose to produce a desired level of block, decreases side effects, less motor blockade and provided more rapid motor recovery of the lower limbs, a benefit very useful after caesarean section [12].

Various studies have documented the use of EVE, where it has been performed using 5ml, 6ml and 10ml volumes of saline. Also, administration of epidural saline after intrathecal injection at 5min was found to be most effective with minimal risk of failures. Levobupivacaine produces the same adverse effects as seen with racemic bupivacaine and other local anesthetics. The most common adverse drug reaction reported is hypotension (31%) followed by nausea (21%), vomiting (14%), headache (9%), procedural pain (8%) and dizziness (6%). The cardiactoxicity, neurological injury after peripheral nerve block and unwanted CNS effects, may be lower than bupivacaine. Allergic type reactions are rare and range in severity from urticaria to anaphylactoid like reaction. During the administration of epidural anaesthesia, it is recommended that a test dose is administered initially and the effects monitored before the full dose is given. A test dose of a short-acting amide anesthetic, such as three milliliters (3 mL) of lignocaine, is recommended to detect unintentional intrathecal administration. Accidental intrathecal injection during epidural blockade can produce high spinal anesthesia with severe hypotension and loss of consciousness.

Methodology

Inclusion criteria

- Parturients in the age group 18 to 35 years.
- Parturients belonging to ASA Class I and II.
- Height 140-160 cm.

Exclusion criteria

- Patient refusal.
- Emergency indication for caesarean section.
- Known hypersensitivity to amide local anesthetics.
- Significant associated medical and obstetric conditions like anaemia, heart disease, PIH, Diabetes mellitus, antepartum bleeding, septicemia and hypertension.
- Absolute contraindications to epidural or spinal anaesthesia technique.
- Height <140 cm and >180 cm.

Methods of collection of data

The study population will be randomly divided into 3 groups with 50 parturients (n=50) in each group by closed sealed opaque envelope method, to receive:

Group A: Intrathecal 7.5mg levo bupivacaine+fentanyl 25 µg without EVE.

Group B: Intrathecal 7.5mg levo bupivacaine+fentanyl 25 µg with EVE (5ml normal saline).

Group C: Intrathecal 7.5mg levo bupivacaine+fentanyl 25 µg with EVE (7.5ml normal saline).

The following parameters was observed and recorded.

- Duration of postoperative pain relief assessed using at interval of 30 minutes or till the time epidural analgesia is administered on complaints of pain at surgical site.
- Adverse effects: Nausea, vomiting, desaturation, hypotension, bradycardia, excessive sedation and others, if any.

Results

Table 1: Comparison of age groups among the study groups

Age group	Group A	Group B	Group C	P value
18 - 25 yrs	29 (58.0)	30 (60.0)	32 (64.0)	0.22
26 - 30 yrs	18 (36.0)	18 (36.0)	11 (22.0)	
> 30 yrs	3 (6.0)	2 (4.0)	7 (14.0)	
Total	50 (100.0)	50 (100.0)	50 (100.0)	

Table 2: Statistical comparison of age among the groups

Parameters	Group A	Group B	Group C	P value
Mean	25.06	24.86	25.14	0.933
StdDev	3.971	3.417	4.175	
Minimun	18	18	18	
Maximum	35	32	34	

In group A the age of the patients selected for the study ranged between 18-35years with mean 25.06 and a standard deviation of 3.971. In group B mean age is 24.86 and standard deviation 3.417, in group C mean age 25.14 and standard deviation 4.175. The difference of proportion of subjects observed between the study groups with respect to age was not statistically significant.

Table 3: Comparison of parity among the groups

Parity	Group A	Group B	Group C	P value
Multigravida	35 (70.0)	29 (58.0)	28 (56.0)	0.299
Primigravida	15 (30.0)	21 (42.0)	22 (44.0)	
Total	50 (100.0)	50 (100.0)	50 (100.0)	

The difference of proportion of subjects observed between the study groups with respect to parity was not found to be statistically significant.

Table 4: Comparison of ASA among the groups

ASA	Group A	Group B	Group C	P value
ASA I	49 (98.0)	50 (100.0)	48 (96.0)	0.091
ASA II	1 (2.0)	0 (0.0)	2 (4.0)	
Total	50 (100.0)	50 (100.0)	50 (100.0)	

Majority 98% of study population belonged to ASA physical status I, only a small percentage 2% of the study groups were of ASA physical status II. The difference of proportion of subjects observed between the study groups with respect to ASA physical status was not statistically significant.

Table 5: Statistical comparison of duration of surgery (mins) among the groups

Parameters	Group A	Group B	Group C	F statistic	P value
No. of cases	50	50	50	5.1	0.007
Mean	42.12	45.04	46.94		
Stddev	7.044	8.063	7.665		
Minimum	30	30	30		
Maximum	60	60	60		

Comparison of duration of surgery among the groups was not found statistically significant.

Table 6: Comparison of side effects among the groups
Side effects

Side effects	Group A (n=49)	Group B (n=50)	Group C (n=50)	P value
Hypotension	19 (38.8)	7 (14.0)	6 (12.0)	0.001
Nausea	2 (4.1)	7 (14.0)	4 (8.0)	0.212
Vomiting	5 (10.2)	7 (14.0)	7 (14.0)	0.808
Bradycardia	2 (4.1)	4 (8.0)	3 (6.0)	0.612
Pruritis	5 (10.2)	3 (6.0)	2 (4.0)	0.453
Headache	0 (0.0)	2 (4.0)	1 (2.0)	0.367

Incidence of hypotension (38%) more in group A comparison with group B and group C and found

statistically significant. Comparison of other adverse effects like nausea, vomiting, bradycardia, pruitis, headache among the group not found statistically significant.

Discussion

Regional anesthesia had become the most preferred technique for cesarean section compared to general anesthesia, since general anesthesia associated with maternal morbidity/mortality. Epidural volume extension (EVE) technique is a unique regional technique, which offers the reliability and rapidity of spinal anesthesia along with flexibility of epidural anesthesia.

It also avoids the degree of sympathectomy that accompanies spinal anesthesia when used alone as the dose of drug being used in EVE's technique. Once the regular dose of spinal local anaesthetic is given and an EVE is used, it rather causes the block to reach higher sensory level, and thus may add to hypotension by increasing the level of associated sympathetic blockade, it can be avoided by low dose of spinal drug along with EVE.

The development of long acting amide local anesthesia levobupivacaine has traditionally focused on ever increasing duration of local anesthetic duration [13, 14].

Clinical importance of this difference may be related to a separation of local anesthesia potency and potential for cardiotoxicity. Further investigation levobupivacaine is less cardiotoxic than bupivacaine.

Conclusion

Incidence of hypotension (38%) more in group A compared with group B and group C and found statistically significant.

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