Original Research Article

A prospective randomized comparative study of low dose versus high dose bupivacaine along with fentanyl and with or without intravenous phenylephrine infusion during caesarean section deliveries under spinal anaesthesia

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Abstract

Introduction: It is imperative on the part of anesthesiologist to be well versed with the anatomy of the vertebral column epidural space and the sub arachnoids space for successful sub arachnoids block. The aim of the study was to quantitatively compare the effect of level of blockade, duration of motor block, changes in haemodynamics and motor block recovery in patients receiving low dose bupivacaine (7 mg) versus high dose bupivacaine (10 mg) with or without phenylephrine infusion under spinal anesthesia for caesarean section deliveries.**Materials and Methods:** This study was carried out on eighty healthy pregnant women of ASA grade I, posted for elective caesarean section under spinal anaesthesia in Government General Hospital, Vijayawada between January 2010 to August 2011, after obtaining ethical committee approval. The patient's age ranging from 19-28 years with normal pregnancies were selected. The height of the patients varied between 150 – 160 cm. Patients were divided randomly in to four groups of 20 each Group A, Group B, Group C and Group D, without any bias. Type of surgery and average duration of surgery were similar in all 4 groups. All patients were informed before surgery about the study and their consent obtained for the same. **Results:** The incidence of hypotension was highest in group B patients (14 out of 20(70%) who received 10 mg of bupivacaine without phenylephrine infusion and lowest in group C patients (2 out of 20 (10%) who received 7 mg of bupivacaine with phenylephrine infusion which is statistically significant (P value < 0.05). **Conclusion:** When given along with a small dose of opioid like fentanyl, low dose bupivacaine (1.4 ml / 7 mg) was as effective as of high dose buypivacaine (10 mg12 ml) in producing adequate relaxation and analgesia. Addition of low dose phenylephrine infusion decreased the incidence of hypotension and maintained better hemodynamic stability in low dose bupivacaine (1.4 ml / 7 mg) group. The Apgar scores of fetus were not affected by dose of bupivacaine, fentanyl or by phenylephrine infusion. The motor recovery was quick in case of low dose bupivacaine groups (B-7mg) with or without phenylephrine which aids in early mobilization of patient.

Keywords: sub arachnoid block, bupivacaine, phenylephrine

Introduction

Anatomy of the vertebral column and Spinal cord: It is imperative on the part of anaesthesiologist to be well versed with the anatomy of the vertebral column epidural space and the sub arachnoid space for successful sub arachnoid block.The vertebral column is composed of 33 vertebrae (7 cervical+ 12 thoracic+ 5 lumbar+5 fused sacral+ 4 coccygeal).It Consists of two curves called the:**Primary curve and Secondary Curve:** At birth there is only the primary curvature that is a single concave curve anteriorly. The secondary curves namely the cervical and the lumbar curves appear as the neonate starts to support his head and starts to sit and stand respectively. A typical vertebra consists of the following parts:

1. **The Body**: It is weight bearing and separated from adjoining vertebral bodies by the intervertebral disc.
2. **Vertebral Arch**: It is composed of pedicles and laminae, which surround and protect the spinal cord and its coverings
3.**The Transverse and spinous processes**: It gives attachment to ligaments and muscles acting on the vertebral column[1-3].

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4. The Superior and inferior articular processes: Each pedicle is grooved, especially, on the lower surface. The grooves are termed the superior and inferior vertebral notches and together make up the intervertebral foramen for the passage of the spinal nerves. The transverse process arises at the junction of the pedicle and the lamina. The posterior surface of the vertebral bodies together with the vertebral arches, intervertebral discs and the connecting ligaments collectively form the vertebral canal containing the spinal cord and its investing membrane.Bupivacaine is one of the homologous series of mepivacaine and this was first synthesized by Ekenstam and his colleagues in 1957 in sweden, and used clinically by I.J.Telivuo in 1963. It has been used for all types of nerve blocks, lumbar and caudal epidurals, para-cervical blocks and intravenous regional analgesia (Ware 1975). Its use in labour pain relief and the duration of action was studied by Telivnuo (1963).In 1680 Sydenham wrote "Among the remedies which it has pleased almighty god to give man to relieve his sufferings none is so universal and so efficacious as opium". The word opium is derived from the Greek word Juice; the juice of poppy plant (papaver somniferum) is the source of 20 distinct alkaloids of opium. OPIATE is the term used to designate drugs derived from opium. The development of new synthetic drugs with morphine like properties has led to the use of the term OPIOID. Opiate choosen for this study is fentanyl Phenylephrine is sympathomimetic vasoconstrictor that has been used as a nasal decongestant for many years. It has one chiral centre and can

exist as either the S(+) or R(-) enantiomer. The R(-) enantiomer is the one used in products containing phenylephrine.

Phenylephrine is chemically related to epinephrine and ephedrine. The aim of the study was to quantitatively compare the effect of level of blockade, duration of motor block, changes in haemodynamics and motor block recovery in patients receiving low dose bupivacaine (7 mg) versus high dose bupivacaine (10 mg) with or without phenylephrine infusion under spinal anesthesia for caesarean section deliveries.

Materials and methods

This study was carried out on eighty healthy pregnant women of ASA grade I, posted for elective caesarean section under spinal anaesthesia in Government General Hospital, Vijayawada between January 2010 to August 2011, after obtaining ethical committee approval. The patient's age ranging from 19-28 years with normal pregnancies were selected. The height of the patients varied between 150 – 160 cm. Patients were divided randomly in to four groups of 20 each Group A, Group B, Group C and Group D, without any bias. Type of surgery and average duration of surgery were similar in all 4 groups. All patients were informed before surgery about the study and their consent obtained for the same.

Group A (n = 20):- These patients received inj.Bupivacaine 0.5% heavy 10 mg [2ml] and inj. fentanyl citrate 25 mcg [0.5 ml] total of 2.5 ml volume intrathecally and they received phenylephrine infusion of 0.25 µg /kg /min intravenously, till the end of surgery.

Group B (n = 20):- Received inj.Bupivacaine 0.5% heavy 10 mg [2ml] and inj. fentanyl citrate 25µg (0.5 ml) total of 2.5ml volume intrathecally without intravenous phenylephrine infusion.

Group C (n= 20):- Received inj.Bupivacaine 0.5% heavy 7 mg(1.4 ml) and inj. fentanyl citrate 25 µg(0.5 ml) and 0.6 ml of normal saline total of 2.5 ml volume intrathecally and phenylephrine infusion of 0.25µg/ kg/ min intravenously, till the end of surgery.

Group D (n= 20):- Received inj. Bupivacaine 0.5 % heavy 7 mg (1.4 ml) and inj.fentanyl citrate 25µg (0.5ml) and 0.6ml of normal saline total of 2.5ml volume intrathecally without intravenous phenylephrine infusion.

Equipment used-

1. Disposable no.25G Quincke spinal. Needle
2. 5ml Disposable plastic syringe
3. 1ml Tuberculin syringe
4. Mediaid SM 100 Syringe Pump with 20 ml Disposable plastic syringe with connection tubing
5. Philips Multiparameter Monitor [Spo_2 , PR, NIBP]

Exclusion Criteria: Patients with pre existing or gestational hypertension, pre eclampsia, cardiovascular or cerebrovascular disease, height less than 150 cm or more than 160 cm and, patients having other contraindications to spinal anesthesia are excluded from the study.

Method

Every patient was subjected to a thorough physical examination with emphasis being laid on cardiovascular system, airway, respiratory system, central nervous system and spine.

Protocol followed:- The patients did not receive any premedication and were on overnight fasting and were allowed to drink clear liquids up to 4 hours before surgery.

The patients were shifted to O.T in left lateral position. Two 18G intravenous cannulae were inserted in each forearm and patients received intravenous prehydration with 20ml/kg ringers lactate solution. Pulse rate, blood pressure and rate of respiration were recorded before starting of spinal anaesthesia, and some were monitored continuously during operative procedure. The patients had indwelling catheter and urine output was monitored.

Technique:- With all aseptic precautions lumbar puncture was performed with 25G Quincke needle in the L_3 - L_4 space in the left lateral position and group specified drugs were injected according to random assignment and patient was immediately placed in supine position with a wedge pillow under the right hip.

All patients received supplementation of oxygen 4 liters /min via polymask. Onset of spinal Anesthesia and level of spinal blockade were observed. Pulse rate, SPO_2 Blood pressure [systolic, diastolic, mean] were recorded every 2 min for the first 10 minutes then at 5minutes interval for remainder of the operation and thereafter at 15min interval until the patient is able to perform bilateral straight leg lift indicating complete motor recovery. The occurrence of side effects like pruritus, nausea, vomiting, shivering etc, were noted. The onset and upper sensory level of anesthesia was assessed by pin prick method.The onset and duration of motor block was noted as per Bromage scale. Motor block duration was defined as the time from the induction of spinal anesthesia until the patient was able to perform a bilateral straight leg lift.The adequacy of relaxation and surgeon comfort was noted in every case.All the women are prehydrated with 20ml/kg of ringers lactate solution intravenously just before spinal anesthesia was induced and intravenous phenylephrine infusion at the rate of 0.25µg/kg/min was started in patients belonging to Group A and C, using a syringe pump at the time of induction of spinal anaesthesia. The intravenous phenylephrine infusion was ended after the completion of surgery.During the surgery the patients received maintenance fluid of just 20 drops/ min of intravenous Ringers lactate solution, unless hypotension is warranted.Hypotension was recognized when systolic blood pressure is less than 90 mm hg or there is ↓ of 25% of baseline SBP. Intravenous fluid rate was increased to 100 drops/min and mephentermine 3mg/i.v aliquots were given to correct the Hypotension. If Hypotension was combined with bradycardia [Heart rate <60 beats/min], Atropine 0.6 mg was given.After delivery 5U oxytocin was added to i.v drip. Apgar scores at 1 min and 5 min interval were recorded.Time from induction of spinal anaesthesia to delivery of the baby was noted in all patients. Postoperatively the patients were observed for recovery of motor blockade, incidence of hypotension and for side effects like pruritus, nausea and vomiting.All the observations and results were recoreded and group wise charts were prepared and analysed[4-7].

Results

The age, Height, Weight of all the patients were analysed as follows:

Table 1: Demographic Profile of 4 groups with mean S.D.Values

	Group A	Group B	Group C	Group D
No. of patients	20	20	20	20
Age in years	25 ± 1.39	24 ± 1.40	24 ± 1.98	24 ± 1.50
Weight in Kgs	60 ± 6.48	61 ± 5.05	60 ± 5.62	61 ± 5.09
Height in Cms	154 ± 3.73	154 ± 3.38	154 ± 3.04	154 ± 3.18

Table 1 shows the distribution of age, weight, Height of the patients. They were found to be similar in all four groups. Mean age was 25 years in group A and 24 years in group B, C and D. Mean weight was 60 kg in group A and group C and 61 kg in group B and D. Mean Height was 154 cm in all 4 groups.

Table 2: Characteristics of Sensory Blockade

It shows the onset and height of sensory blockade in all the group of patients.

Sensory blockade – Mean value (S – D)				
	Group A	Group C	Group C	Group D
Height of Sensory Level (Median)	T4 [T3 – T6]	T4 [T3 – T6]	T4 [T3 – T6]	T4 [T3 – T6]
Time for injection to highest sensory level (Min)	5.7 ± 1.34	5.8 ± 1.22	5.8 ± 0.98	6.0 ± 1.20

Table 2 shows the highest sensory level is similar in four groups. The difference in time for injection to highest sensory level was statistically insignificant in four groups, [p value >0.05]. It shows the onset and height of sensory blockade are equal in all the group of patients.

Table 3: Characteristics of Motor Blockade

The following (Table 3) shows the onset and duration of Motor blockade.

Motor blockade – Mean value (S.D)				
	Group A	Group B	Group C	Group D
Onset of grade 3 motor block (Min)	5.7 ± 0.65	6.0 ± 0.79	6.0 ± 0.82	± 0.91
Duration of motor block (Min)	145 ± 4.43	142 ± 4.12	98 ± 4.99	101 ± 9.11

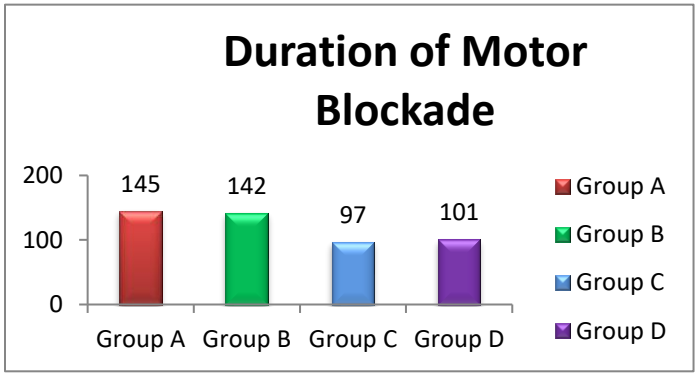

Fig 1: Duration of motor blockade

The onset of motor blockade was almost similar in all four groups and the difference in onset was statistically insignificant [P value > 0.05], the duration of motor blockade varied from high dose bupivacaine (B-10mg) groups of A and B to low dose bupivacaine (B-7g) groups C and D.The Group C and Group D patients who received 1.4 ml [7 mg] of bupivacaine had quick recovery time compared to Group A and B, who received 2 ml[10 mg] of bupivacaine which was statistically significant, [P value <0.05].Surgeon's comfort and adequacy of motor blockade was satisfactory in all groups. There is no difficulty in operating condition in group C & D (low dose bupivacaine, B-7 mg) when compared to groups A and B (High dose bupivacaine, B- 10 mg)[8-10].

Table 4: Baselines of Hemodynamics before starting of Anaeshesia

	Group A	**Group B**	**Group C**	**Group D**
SBP, mmHg	126 ± 4.76	129 ± 4.31	121 ± 5.30	124 ± 5.68
MAP, mmHg	92 ± 3.78	92 ± 4.65	92 ± 7.70	92 ± 4.00
DBP, mmHg	76 ± 4.21	75 ± 4.18	79 ± 6.54	77 ± 3.81
PR, beats / min	89 ± 3.96	91 ± 5.89	89 ± 4.12	90 ± 4.83

The above table shows the baseline haemodynamics before starting of the spinal anaesthesia after preloading of patients with 20ml/kg of RL Solution. They were found to be similar in four groups. The difference in baseline hemodynamics between the 4 groups was statistically insignificant [P Value > 0.05].

Table 5: Characteristics of hemodynamic variables

The following table 5 shows the incidence of hypotension and bradycardia in all the groups.

	Group A (n=20)	**Group B (n=20)**	**Group C (n=20)**	**Group D (n=20)**
Hypotension [SBP < 90 mmHg]	7 [35%]	14 [70%]	2 [10%]	6 [30%]
Bradycardia [HR < 60 min]	3 [15%]	0	2 [10%]	0

The incidence of hypotension was highest in group B patients (14 out of 20(70%) who received 10 mg of bupivacaine without phenylephrine infusion and lowest in group C patients (2 out of 20 (10%) who received 7 mg of bupivacaine with phenylephrine infusion which is statistically significant (P value < 0.05). Bradycardia was observed in 3 patients in Group A and 2 patients in group C, without any significant difference.

Maximum changes in systolic blood pressure and Mean arterial blood pressure

The following Table 6 shows maximum changes in SBP and MAP. The values are presented as Mean

Table 6: Maximum changes in systolic blood pressure and Mean arterial blood pressure

	Group A	Group B	Group C	Group D
SBP (mmHg)				
Mini mm (mmHg)	97	91	111	101
Change	29	38	10	23
% Change	23	30	8	19
Time (Min)	8	8	10	8
MAP, mmHg				
Minimum	72	65	81	74
Change, mmHg	20	27	12	18
% Change	22	29	13	20
Time, (Min)	8	8	8	10

% Change = Percentage change from baseline, **Minimum =** Mean minimum values in systolic blood pressure. **Time =** Time from induction of spinal anesthesia to lowest systolic blood pressure.

The differerence in SBP and MAP are more significant when group B (B- 10 mg without phenylphrine) was compared to Group C (B-7mg with phenylephrine). This shows that high dose bupivacaine without phenylephrine has more hemodynamic changes when compared to low dose bupivacaine group with phenylephrine. Among the phenylephrine groups A and C the percentage of change of SBP and MAP were more in case of Group A who received high dose of bupivacaine. The following table 7 shows the number of patients who received Mephenteramine and atropine to maintain the drop in hemodynamic changes.

Table 7: Number of patients who received Mephenteramine and atropine to maintain the drop in hemodynamic changes.

	Group A[B_{10} + Fentanyl + Phenylephrine]	**Group B[B_{10} + Fentanyl]**	**Group C[B_7 + Fentanyl + Phenylephrine]**	**Group D[B_7 + Fentanyl]**
Mephenteramine	7	14	2	6
Atropine	3	0	2	0

This significantly proves the incidence of hypotension and requirement of Mephenteramine was very much low in patients who received low dose of bupivacaine (B-7mg) with phenylephrine infusion.

Table 8: Distribution of Mephentermine doses in 4 groups

No. of Mephentermine (1 dose = 3mg)	**Group A [B_{10} + Fentanyl + Phenylephrine] (n=7)**	**Group B [B_{10} + Fentanyl] (n=14)**	**Group C [B_7 + Fentanyl + Phenylephrine] (n=2)**	**Group D [B_7 + Fentanyl] (n=6)**
1 dose	4	5	2	4
2 doses	3	6	-	2
3 doses	-	3	-	-
Total	10	26	2	8

The distribution of Mephenteramine alliquots (1dose = 3mg) was also more in case of group B patients (26 alliquots were given to 14 patients) compared to group C who received (only 2 alliquots which were given to 2 patients). Number of patients who received 3 doses of Mephenteramine were present only in Group B. In Group C 2 patients received only single dose of Mephenteramine.

Table 9: APGAR Score

Apgar Score	**Group A**	**Group B**	**Group C**	**Group D**
1 Min	8 to 9	7 to 9	8 to 9	8 to 9
5 Min	9 to 10	9 to 10	9 to 10	9 to 10

Table 8 shows no significant difference in neonatal Apgar Scores in 4 groups.

Table 10: Incidence of side effects

The following table shows incidence of side effects during Intraoperative and postoperative period in all the groups.

	Group A (n=20)	**Group B (n=20)**	**Group C (n=20)**	**Group D (n=20)**
Respiratory depression [SaO2 <90%]	0	0	0	0
Emetic episodes [nausea and vomiting]	6 [30%]	10 [50%]	1 [5%]	4 [20%]

Pruritis	14 [70%]	12 [60%]	11 [55%]	14 [70%]
Shivering	0	0	0	0
Others if any	0	0	0	0

Respiratory depression was not observed in any patient of the study proving that low dose intrathecal fentanyl has no significant effect on respiration.The incidence of nausea and vomiting was highest (50%) in Group B patient (B-10 mg without phenylephrine) who also had highest incidence of hypotension and also received more doses of Mephenteramine.The incidence of pruritus was almost equal in all the groups indicating the effect of fentanyl. The pruritus was not embrassing and limited in nature and subsided within one day in all the cases.Shivering has not been observed in any patient in all the groups.

Discussion

Gregory L et al (2007) compared 4.5 mg and 12 mg dose of intrathecal bupivacaine on maternal hemodynamics. All patients received 50 mcg of fentanyl and 200mcg of morphine intrathecally. I.V fluid and vasopressor administration was standardized. Both groups yielded similar sensory blockade and side effects during caesarean delivery. Patients receiving 4.5mg bupivacaine did however exhibited significant lower duration of motor blockade. The surgeons experienced operationg conditions as good and very good in 24 out of 27 patients, i.e 91% in 4.5 mg group. This study also suggested that intrathecal fentanyl in doses less than 30mcg was associated with 50% reduction in pruritus with comparable rates of nausea and vomiting when compared to high doses of fentanyl (i.e 40-60 µg). But however they could not make out reduced incidence of hypotension and use of vasopressors in low dose bupivacaine group.Marc Vande velde et al (2006) studied the dose dependent effects of hyperbaric bupivacaine on maternal hemodynamics and showed that small dose of bupivacaine with fentanyl better preserves hemodynamic stability resulting in equally effective anaesthesia.Tejwani GA et al [1992] in their study showed that opioids and local anesthetics administered together intrathecally had synergistic analgesic effect possible to achieve spinal anaesthesia using otherwise inadequate doses of local anaesthetics with less hypotension. Opioids have been proved to give more intensity of block and quicker onset time when added as an adjunct to spinal anaesthetic without altering hemodynamic stability. Since, low dose bupivacaine will be better effective along with an opioid like fentanyl. It was added in this study in all the groups of patients along with bupivacaine. Choi et al [2000] found complete analgesia excellent muscle relaxation with intrathecal hyperbaric bupivacaine 8mg with 10mcg fentanyl.Recently Lew et al [2004] using combined spinal anaesthesia with epidural volume extension for LSCS in adose of 5mg of 0.5% bupivacaine with fentanyl 10 mcg intrathecally followed by 0.9% saline 6.0 ml through the epidural catheter, found a significantly faster motor block recovery (73 $\pm$ 33 min) as compared to spinal anaesthesia with 0.5% bupivacaine 9 mg with 10 mcg fentanyl (136 $\pm$ 32 min).Warwick D.Nagankeeetal, Kim.S.Khaw etal (2005) in their study have described, combination of highdose (100 mcg / min) phenylephrine started immediately after spinal injection and rapid crystalloid cohydration effectively prevented hypotension during caesarean delivery. Warwick D.Ngan kee.kim.S.Khaw (2004) have studied the Apgar scores. They compared the effect of high dose infusion of phenylephrine with intermittent phenylephrine bolus on umbilical blood gas values and Apgar score. They showed that they were maintained similar in both groups. This indicates, there is no significant effect of phenylephrine on Apgar score while maintaining effective arterial pressure during spinal anaesthesia for caesarean delivery.Eldrid langesaeteretal (2008) study shows that low dose bupivacaine with sufentanyl, infusion of low dose phenylephrine and moderate cohydration gives best hemodynamic stability under spinal anaesthesia during caesarean section deliveries.Cooper et al [2002] studied on fetal and maternal effects of phenylephrine and ephedrine during spinal anaesthesia for caesarean section demonstrated that giving phenylephrine alone with infusion is associated with decreased incidence of fetal acidosis, maternal nausea and vomiting than giving ephedrine alone or ephedrine in combination with phenylephrine. This shows that more nausea and vomiting may have secondary evidence for vagal mechanism likely to occur if there is a beta adrenergic stimulant which is more in ephedrine group.Warwick. D.Ngan Kee etal [2009] study has compared fetal, metabolic effects using phenylephrine and ephedrine during spinal anaesthesia and concluded during spinal anaesthesia and that overall effect of vasopressors on fetal oxygen supply and demand balance may favour phenylephrine. There is a greater placental transfer of ephedrine compared to phenylephrine, may be due to greater lipid solubility. Ephedrine also crosses blood brain barrier and has central stimulant and appetite suppressant effect.Phenylephrine which is an alpha agonist a more prominent venoconstrictor. During caesarean sections phenylephrine maintains maternal systolic blood pressure at baseline and is associated with low incidence of fetal acidosis than that of ephedrine (cooper etal 2002) . A very low dose of phenylephrine infusion (0.25 ug / kg/ min) by a syringe pump was selected and was given in 2 groups of patients. Other two groups does not received phenylephrine infusion.

Out of the four groups selected for study all groups patients received fentanyl 25mcg added to highdose bupivacaine [B-10 mg/2ml] groups A and B and in low dose bupivacaine (B-7 mg/ 1.4 ml) groups C and D. Out of this A and C groups received continuous infusion of low dose [0.25 µ/kg/min] of phenylephrine through intravenous syringe pump continuously till the end of surgery.

Effect on hemodynamics

The hemodynamic curves depicted on page number (55, 56) clearly shows that there is a maximum fall of SBP and MAP around 6 – 12 minutes after induction of spinal anaesthesia in all groups of patients.Group C patients who received low dose bupivacaine 7 mg with 25 mcg fentanyl and phenylephrine infusion has faired well and there is minimal drop of SBP and MAP when compared to other groups.

Group B patients who received high dose bupivacaine 10 mg with 25mcg fentanyl without phenylephrine has faired poorly and has resulted in maximum fall of SBP and MAP.Group A [B-10mg with phenylephrine] and Group D (B-7mg without phenylephrine] had intermittent drop in blood pressures, when compared to above two groups. Their drop is almost identical. This shows that low dose bupivacaine without phenylephrine faired better next to group C (B-7mg with phenylephrine) and high dose bupivacaine group (B-10 mg) to get the same result has to be given infusion of phenylephrine.In order to maintain volume load constant all patients in all groups received prehydration with 20 ml/kg of ringers lactate solution before initiation of spinal anaesthesia and they received a low maintainance fluid in all groups of patients irrespective of mephenteramine administration.The p Values of group C (B-7 mg with phenylephrine) are significant showing that adding up of phenylephrine has more hemodynamic stability and less fall in SBP and MAP.The P values of group A (B- 10mg with phenylephrine) and group B (B–10 mg without phenylephrine) which are high dose groups also showed significant difference, showing addition of phenylephrine resulted in better

hemodynamic stability.The hypotensive episodes that occurred in number of patients is more in group B [B-10 mg without phenylephrine i.e 14 out of 20-70%). It is minimal in group C (B-7mg with phenylephrine i.e 2 out of 20 – 10%).The percentage drop of SBP and MAP from baseline is also maximum in group B and minimum in Group C patients.The number of doses of Mephenteramine administered are also significant low in group C patients [B-7 mg with phenylephrine].In Group B patients the number of Mephenteramine doses varied from 1to3 in single patient according to severity of drop in blood pressure and they received maximum number of mephenteramine doses when compared to other groups[11,12].

The mean pulse rate was little lower in case of patients who received phenylephrine than in patients who does not receive phenylephrine. This was same in high dose and low dose bupivacaine groups. This shows a low dose phenylephrine infusion produce better hemodynamic stability and maintains the pulse rate nearer to baseline.Level of sensory blocade and duration of motor blockade. The onset and height of sensory blockade was almost similar in all patients in all groups. The height of sensory block obtained was average T4 [T_3– T_6].The difference which was siginificant was found in the recovery of motor blockade which was around 145 min in case of high dose bupivacaine (10mg) groups A and B and it is low which is around 100 min in case of low dose (7 mg) bupivacaine groups C and D. The addition of phenylephrine infusion has found to have no effect on the recovery of motor blockade. Group C and D patients had quick recovery time when compared to Group A and B patiens which was statically significant ($P < 0.05$). It indicates low dose bupivacaine group patients can be made ambulatory at the earliest and also had better hemodynamic stabilty.Apgar scores of fetus were similar in all the groups. No foetal distress was noted in any of the deliveries. The umbilical cord PH values were not evaluated in this study.

Side effects: None of the patiens had respiratory depression ($SPO_2 < 90\%$). This shows that addition of low dose fentanyl intrathecally does not have effect on respiration. Emetic episodes (nausea and vomiting) were more in group B patients (B-10 mg) without phenylephrine) which also had more hypotensive episodes. Emetic episodes were less in Group C patiens (B – 7mg with phenylephrine). Even in group B there is no severe nausea and vomiting which is usually self limited and does not required any treatment. It is to note that in any of our patiens does not received any premedication with rantidine and Metaclopromide. Probably addition of these drugs may reduce the incidence of nausea and vomiting further.Pruritus was found in all groups of patients (55 – 70%). It was mild, self limited, subsided within one day and does not required any treatment. Shivering and other side effects were not observed in any of the patients in all the groups.The result shows that, keeping in view of the average height and weight of patients who are coming for LSCS in our region, just need a minimal dose of hyperbaric bupivacaine (1.4 ml / 7mg) along with 25 mcg of fentanyl for adequate level and degree of block, maintaining better hemodynamic stability if it is added with continuous infusion of low dose phenylephrine (0.25 µ/ kg/min).

Conclusion

When given along with a small dose of opioid like fentanyl, low dose bupivacaine (1.4 ml / 7 mg) was as effective as of high dose bupivacaine (10 mg12 ml) in producing adequate relaxation and analgesia. Addition of low dose phenylephrine infusion decreased the incidence of hypotension and maintained better hemodynamic stability in low dose bupivacaine (1.4 ml / 7 mg) group. The Apgar scores of fetus were not affected by dose of bupivacaine, fentanyl or by phenylephrine infusion. The motor recovery was quick in case of low dose bupivacaine groups (B-7mg) with or without phenylephrine which aids in early mobilization of patient.The doses of vasopressors required are very much minimal or negligible in case of low dose (B-7mg) bupivacaine with phenylephrine infusion and better hemodynamic stability was maintained in this group. The side effects like nausea and vomiting are also low in case of low dose (B-7mg) bupivacaine with phenylephrine group[13-15].

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