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Original Research Article

Synergistic effect of inthrathecal fentanyl and bupivacaine in spinal anesthesia for cesarean section in Baghdad city

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ABSTRACT

Background: Potentiating the effect of intrathecal local anesthetics drugs by addition of intrathecal opiods for intra-abdominal surgeries had been used lately. In this study by addition of fentanyl, we tried to minimize the dose of bupivacaine thereby reducing the side effect caused by higher doses of intrathecal bupivacaine in cesarean section, and to improve the quality of block.
Methods: Study was performed on sixty patients underwent cesarean section they were divided into 6 groups as B10, B 12.5, B15 mg of bupivacaine and FB10, FB12.5, FB15 received a combination of 25 µg intrathecal fentanyl respectively, the parameter taken into consideration were visceral pain, hemodynamic stability (hypotension and bradycardia) intra operative sedation, nausea, vomiting and post-operative pain.
Results: Onset of sensory block to T6 occurred faster with increasing bupivacaine doses in bupivacaine only groups and bupivacaine fentanyl combination groups. Alone lower concentration of bupivacaine could not completely remove the visceral pain. Blood pressure declined with increasing the concentration of bupivacaine and fentanyl. The incidence of nausea and vomiting was reduced significantly while post-operative pain relief and hemodynamics stability increased by adding fentanyl. Pruritis, maternal respiratory depression and changes in APGAR score of babies did not occur with fentanyl.
Conclusions: Spinal anesthesia among the neuro axial blocks in obstetric patients' needs strict dose calculation because minimal dose changes results in more complications and side effects Here the synergistics potentiating effects of fentanyl (an opiod) on bupivicaine (local anesthetic) in spinal anesthesia for cesarean section is presented. Fentanyl is able to reduce a dose of bupivicaine and therefore its harmful effect.

Keywords: Cesarean section, Spinal anesthesia, Bupivacaine, Fentanyl

INTRODUCTION

Spinal anesthesia is the preferred anesthetic technique for cesarean section being simple to perform, economical and produces rapid onset of anesthesia and acceptable Muscle relaxation. It carries high efficiency involves less drug doses, minimal neonatal depression, awake mother and lesser incidence of aspiration pneumonitis. However, it also produces fixed duration of anesthesia, may produce post dural puncture headache, hypotension and lesser control of block height.[1] Spinal anesthesia blocks nerve roots as they course through the subarachnoid space, this space extends from foramen magnum to the S2 in adults and S3 in children. Injection of local anesthetics below L1 in adults and L3 in children helps avoid direct trauma to the spinal cord. Spinal needles are commercially available in any array of sizes (16-30 gauge) lengths and bevels and tip designs. All should have tightly fitting removable stylet that completely occludes the lumen to avoid tracking epithelial cells into the subarachnoid

space. Broadly, they can be divided into either sharp (cutting) tipped or blunt tipped needles.

Specific techniques for spinal anesthesia

The midline, paramedian or prone approach can be used for spinal anesthesia , the needle is advanced from skin through the deeper structures until two pops are felt.

The first is ligamentum flavum and the second is penetration of the dura arachnoid membrane. Successful dura puncture is confirmed by withdrawing the stylets to verify free flow of CSF. With small gauge needles (<25 g) particularly in the presence of low CSF pressure (e.g. dehydrated patient) aspiration maybe necessary to detect CSF.[2] Bupivicaine is an amide type of local anesthetic agent introduced in 1963 of slower onset of action (5-8 minuits) and longer duration than Lidocaine (1.5-2 hours). The addition of adrenaline does not prolong the effect of bupivicaine as much as with lidocaine. Bupivicaine is extensively bound to tissue and plasma proteins Pka 8.1 more cardiotoxicthan lidocaine, mainly metabolized by the liver small amount is excreted unchanged in the urine. Widely used for conduction, spinal and extradural anesthesia 0.25%-0.5% solutions are used for most purposes.[3]

For cesarean section intrathecal dose of hyperbaric bupivicaine is 12-15 mg.[4] Cesarean delivery requires traction of peritoneum and handling of intra peritoneal organs resulting in intraoperative visceral pain. With higher doses of hyperbaric bupivicaine the incidence of intraoperative visceral pain associated with higher blocks reduced.[5,6] This study aimed to monitor the effect of intrathecal fentanyl and bupivicaine on reduction of higher blocks incidence simultaneously improving the quality and avoiding the complication of higher doses of local anesthetics used in spinal anesthesia in cesarean section. The study can be implicated to select the best possible combination of local anesthetics and fentanyl used in cesarean section.

METHODS

This study was performed at medical city complex in the department of obstetrics and gynecology in Baghdad teaching hospital. All the patients taken from this study belonged to the American society of anesthesiology (ASA) grade 1 or 2, which is a classification system for assessing the pre-operative physical status. Grade 1: healthy patient, grade 2 mild systemic disease with no functional limitation. None of the patients had any contraindication for spinal anesthesia.

Complicated pregnancies as multiple pregnancies, pregnancy induce hypertension and placenta previa were excluded. Also, the patient with acute fetal distress were excluded keeping the respiratory depressant effect of fentanyl in mind. Prospective single blind study was performed on 60 patients. in the first group of 30 patients we tried to find the optimal dose of intrathecal bupivicaine which was not associated with visceral pain, in the second group of 30 patient intrathecal fentanyl was added to varying dose of bupivicaine. The second group was planned with the idea to find out the lowest dose of bupivacaine fentanyl combination that was not associated with visceral pain. The first group of 30 patient was further subdivided into 3 subgroups receiving 10, 12.5, 15 mg of 0.5% of hyperbaric bupivicaine respectively. The second group also of 30 patient was again subdivided into 3 subgroups receiving 10, 12.5, 15 mg of 0.5% hyperbaric intrathecal bupivicaine mixed with 25 µg of intrathecal fentanyl.

Spinal anesthesia was given in sitting position. For lumber puncture 25-gauge needle was used. Immediately after the block each patient was placed with 10 cm wedge under right hip. Pulse and non-invasive blood pressure were measured every 5 minutes for the first 30 minutes and thereafter every 10 minutes. If the systolic blood pressure falls below 90 mmHg additional vasopressor support was given. Sensory block was tested by pinprick at the left midclavicular line till the block reach T6 when the surgical incision will be allowed.

Muscle relaxation was assessed clinically and rated as poor, fair, good or excellent and and score of 1, 2, 3, 4 was given for each description respectively. Incidence of nausea, vomiting, itching, shivering pruritis and sedation during operation, the time required for recovery of sensory block down to T10 and the onset of postoperative pain was recorded, all these time variables were measured from the beginning of the spinal injection. Data analysis was done using SPSS version 23.0.

RESULTS

The study was performed on 60 patients under went cesarean section under spinal anesthesia. 6 groups (ten each) were allocated as follows according to intrathecal medication. All 6 groups were almost of similar age (20±3 years), height (155±5 cm), weight (70±10 kg), group 1-B10 (10 mg 0.5% hyperbaric bupivacaine), group 2-B12.5 (12.5 mg 0.5% hyperbaric bupivacaine), group 3B15 (15 mg 0.5% hyperbaric bupivacaine), group 4-FB10 (10 mg 0.5% hyperbaric bupivacaine and 25 µg fentanyl), group 5-FB 12.5 (12.5 mg 0.5% hyperbaric bupivacaine and 25µg fentanyl), group 6-FB 15 (15 mg 0.5% hyperbaric bupivacaine and 25µg fentanyl). The onset of sensory block to T6 occured faster with increasing bupivicaine doses in the alone or in lesser combination groups with fentanyl.

Muscle relaxation was excellent in all patients in all groups, about 90-100 % of patients had acceptable motor block with no significant difference in different groups. No visceral pain was noticed in any of the combination treated group as well as group 3 receiving 15 mg of bupivicaine the incidence of visceral pain was significantly higher in B10, B12.5.

Table 1: Side effects resulted from medication for each group of patients.

Groups	Side effects				
	Hypotension %	Bradycardia %	IOS* %	Nausea %	Vomiting %
1	20	10	0	40	10
2	30	10	0	50	30
3	50	20	0	40	10
4	20	10	90	20	10
5	40	10	70	30	10
6	60	20	80	10	10

Table 2: Bradycardia changes within the 6 groups.

Groups	Bradycardia		P value
	No	Yes	
1	9	1	0.949
2	9	1	
3	8	2	
4	9	1	
5	9	1	
6	8	2	

Table 3: The relationship between sedation and the 6 groups of patients.

Groups	Sedation		P value
	No	Yes	
1	10	0	<0.001
2	10	0	
3	10	0	
4	1	9	
5	3	7	
6	2	8	

Maximum fall in systolic blood pressure was noticed after 25 minutes in all groups depending upon percentage of systolic blood pressure fall the following series can be drawn: FB15>B15, FB12.5>B12.5, FB10>B10. On comparing the hemodynamics stability of equipotent dose of bupivicaine and bupivicaine fentanyl, we found that the later is more stable. We found the intraoperative hypotension increases with increasing doses of bupivicaine however, along with fentanyl it increased more. Bradycardia was found in 10-20% cases in each group, there was no statistical significance in the incidence of Bradycardia in different groups as shown in (Table 2). There was no intraoperative sedation in bupivicaine whereas 70-90% of patient of bupivicaine fentanyl combination groups were drowsy but arousable. The incidence of vomiting was more in bupivicaine alone groups than in combination groups as shown in (Table 3).

The duration of post-operative analgesia increased with increasing dose of bupivicaine. Also, addition of fentanyl to bupivicaine increased the post-operative analgesic effect. Motor recovery takes longer with the increasing doses of bupivicaine alone or in combination with fentanyl. Apgar score of babies was unaffected when additive dose of 25 µg of intrathecal fentanyl was used in cesarean section.

DISCUSSION

Recent trends of obstetric anesthesia had shown increased popularity of regional anesthesia among obstetric anesthetists. General anesthesia is associated with higher mortality rate in comparison to regional however regional anesthesia is not without risk. Deaths in regional anesthesia are primarily related to excessive high regional blocks and toxicity of local anesthetics. Reduction in doses and improvement in technique to avoid higher block levels and heightened awareness to the toxicity of local anesthetics have contributed to the reduction of complications related with regional anesthesia.[7] Spinal anesthesia among the neuroaxial blocks in obstetric patients' needs more strict dose calculation as the drugs are directly injected in intrathecal space with minimum dose changes. The chances of complications and side effects are enhanced.[1] These days 0.5% heavy dose of bupivicaine is used commonly for spinal and epidural anesthesia. It was decided to combine it with intrathecal fentanyl to provide adequate depth of anesthesia with lesser doses of bupivicaine.[8] Fentanyl is lipophilic opiod and is preferred for having rapid onset and short duration of action with lesser incidence of respiratory depression. Our results of onset time of sensory block to T6 corroborate with that of Randalla et al which stat that the onset of sensory block to T4 gets faster which increasing bupivacaine doses whether it differs from observations of Singh et al.[9,10] Acceptable motot block was achieved in 90-100% in all patients in our study. This is in accordance with results of Choi et al.[11] visceral pain is common problem in cesarean section in spinal anesthesia, in our study we found no painin B15 group however visceral pain wasn't fully abolished with lower doses of bupivicaine.our results corroborate fully with Choi et al.[11] It is evident from the results that the depth of anesthesia in FB10 group is equivelant to B15 group, this proves that by adding fentanyl adequate depth of spinal anesthesia can be achieved at much lower doses of bupivicaine. The incidence of hypotension as well as the rate of falling in systolic blood pressure increases with the dose of bupivicaine.

Table 4: The relationship between sensory block to T6 and post-operative pain relief within the 6 groups.

Groups	Sensory block (mean±SD)	P value	Post operative pain relief (mean±SD)	P value
1	9.90±1.10	<0.001	79.5±4.37	<0.001
2	7.80±0.63		90.0±6.66	
3	6.00±0.66		96.5±6.68	
4	6.90±0.56		110.0±6.66	
5	6.00±0.66		119.0±5.67	
6	5.00±0.66		140.0±6.66	

Bradycardia results from blockade of sympathetic cardio accelerator fibers and decreased venous return to the heart. In our study the incidence of bradycardia was over all 10% with no significant intergroup variation, this is in accordance with Singh et al.[10] About 70-90% of patients became drowsy but arousable with the addition of fentanyl in comparison with those without fentanyl. We found significant reduction in the incidence of nausea when fentanyl added to bupivicaine, further negligible incidences of pruritus, shivering or respiratory depression were observed, also the APGAR score of the babies remained the same in all groups, there was longer duration of postoperative analgesia n fentanyl bupivicaine groups, this is also increases with increasing dose of bupivicaine, however motor recovery was not affected by the addition of fentanyl.

CONCLUSION

The above study concluded that bupivicaine fentanyl combination leads to abolishment of visceral pain, reduction in the incidence of nausea, increase hemodynamics stability and increases duration of post-operative analgesia , however no effect could be seen on bradycardia, shivering, maternal or neonatal respiration thus over all the combined effect of fentanyl bupivicaine is superior over just bupivicaine alone as fentanyl apart from positive effect retards the negativity as well as reduces the doses of bupivicaine too. So, we can conclude that group 4 who received 10 mg bupivicaine+25 mg fentanyl is the best group to be used.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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