COMPARISON OF 0.5% AND 0.75% HYPERBARIC BUPIVACAINE GIVEN INTRATHECALLY IN ELECTIVE LOWER SEGMENT CAESAREAN SECTION

Qurrat-Ul-Ain Amjad[1✉], Asjad Sharif[2], Amanat Khan[2]

ABSTRACT

OBJECTIVE: To compare the effects on hemodynamic stability, level of block, patient's comfort, nausea and vomiting using 0.5% and 0.75% hyperbaric bupivacaine in lower segment caesarean section.

METHODS: A total of 100 patients, having American Society of Anesthesiology status I/II, aged 20 to 40 years, scheduled for elective lower segment caesarean section were selected through consecutive non-probability sampling technique. Patients were randomly allocated by lottery method to either the group I (n=50) to whom 0.5% hyperbaric bupivacaine was given or group II (n=50) to which 0.75% hyperbaric bupivacaine was administered. Hemodynamic parameters were noted 03 minutes apart for first 30 minutes. Block level was confirmed to cold using ethyl chloride spray. Pain, uneasiness, nausea and vomiting were also noted. Student t-test and Chi square tests were applied where appropriate.

RESULTS: Both groups were comparable in terms of age, weight, height and duration of surgery. There was no significant difference between heart rate, fall in blood pressure in both the groups. Block level at T4 level was observed in 78% & 50% in group I & II respectively and at T6 level in 22% & 50% in group I & II respectively ($p<0.05$). Uneasiness/discomfort (48%) and nausea/vomiting (34%) were observed in group II only ($p<0.05$).

CONCLUSION: Hemodynamic parameters in both groups showed no significant difference. However, patients administered with 0.5% hyperbaric bupivacaine for lower segment caesarean section showed more appropriate levels of block, less incidence of nausea and vomiting, and more patient comfort as compared to 0.75% hyperbaric bupivacaine.

KEY WORDS: Bupivacaine (MeSH), Anesthesia; Spinal (MeSH), Cesarean Section (MeSH), Hemodynamic parameters (Non-MeSH), Level of block (Non-MeSH).

THIS ARTICLE MAY BE CITED AS: Amjad QUA, Sharif A, Khan A. Comparison of 0.5% and 0.75% hyperbaric bupivacaine given intrathecally in elective lower segment caesarean section. Khyber Med Univ J 2016; 8(2): 78-81.

[1✉]Department of anesthesia, CMH Rawalpindi, Pakistan.
Email: qurratulain_amjad@yahoo.com
[2] Associate professor, department of anesthesia CMH Rawalpindi, Pakistan.

Date Submitted: September 19, 2015
Date Revised: April 06, 2016
Date Accepted: April 09, 2016

INTRODUCTION

Spinal anesthesia is a reversible nerve transmission interruption caused by injection of local anesthetic in subarachnoid space.[1] Regional anesthesia techniques have several advantages, including decreased risk of failed intubation, aspiration of gastric contents and avoidance of cardio depressant agents.[2] Spinal anesthesia is a common, safe, economical, easy to perform and effective technique which provides rapid and reliable anesthesia with muscle relaxation for patients undergoing lower abdominal surgery.[3]

Bupivacaine is long acting local anesthetic used for most locoregional procedures.[4] Bupivacaine is an amide local anesthetic used in hyperbaric and isobaric form.[5] Baricity manipulation of local anesthetic is made to achieve level of sensory block in a better way. Too high block is unnecessary and can compromise the patient's hemodynamic status.[5] Effects of spinal anesthesia on the cardiovascular system is primarily indirect and occurs through blockade of sympathetic nervous system and includes a reflex response to the primary cardiovascular effects. Most significant and easily measurable hemodynamic effects of spinal anesthesia are changes in blood pressure and heart rate.[1]

In the subarachnoid space anesthetics act depending on their baricity. Hyperbaric being heavier than the cerebrospinal fluid goes in the lowest part of the subarachnoid space of the patient in lying position while isobaric anesthetic keeps on floating in subarachnoid space.[5] Because the sitting position is frequently used for induction of spinal anesthesia, hyperbaric solutions, under the influence of gravity, would be expected to spread caudally, whereas hypobaric solutions would be expected to distribute rostrally.[6] Therefore; the volume and amount of anesthetic agent, the intervertebral level at which the anesthetic agent is given and the position of the patient while giving spinal anesthesia potentially affect the block level. So the protocol for spinal anesthesia was identical in all patients during the study.

Several studies state that no statistically significant difference was found for episodes of hypotension, bradycardia and use of ephedrine and atropine between the two groups of patients either receiving hyperbaric or isobaric bupivacaine.[7]

An alike study showed that the incidence of hypotension, nausea and vomiting were similar among the two groups.[6]

Therefore; the aim of this study was to present and analyze the differences in the behaviour of basic hemodynamic parameters, level of block, nausea and vomiting and patient's comfort, before and after administering same local anesthetic agent (hyperbaric bupivacaine) intrathecally but with different concentrations.

METHODS

This randomized control trial was carried out at Anesthesia department of Combined Military Hospital Rawalpindi, which is a tertiary care hospital for duration of six months from 01st July 2014 to 01st Jan 2015.

The inclusion criteria were; female patients aged 20-40 years, having American Society of Anesthesiology (ASA) status-I/ II and weight between 50kg to 100kg. Patients with gestational diabetes and pregnancy induced hypertension (PIH), valvular heart disease, bleeding disorders, American society of anesthesiology (ASA) status-III/ IV, infection at site of injection and Emergency Caesarean Sections were excluded from the study.

Approval was obtained from the hospital ethical committee. Sample was collected by consecutive non-probability sampling technique. Purpose and procedure of the comparative study of hypebaric 0.5% and 0.75% bupivacaine for spinal anesthesia was explained to the patients and an informed written consent was obtained. Those who were willing and were eligible for the study were randomly allocated by lottery method to two equal sized (n=50 each) groups (I and II).

The group I patients received 2.1 ml of 0.5% hyperbaric bupivacaine with baricity of 1.020 made by factory incorporation of glucose in solution in an anesthetic concentration of 8.25% and group II patients received 1.4 ml of 0.75% hyperbaric bupivacaine. Patients were subjected to elective lower segment caesarean section.

All patients were fasting for 06 hours and were infused intravenous preload of 10ml/kg of Ringers Lactate solution before surgery.

Spinal anesthesia was given by resident anesthesiologist in all patients in the same way after lumbar puncture in sitting position at LV3 –LV4 intervertebral space over 15 seconds after confirming free flow of clear CSF in all four quadrants using 25 G Quincke spinal needle with the tip of needle directed cranially with no barbitage.

Hemodynamic parameters including ECG, heart rate, non-invasive blood pressure, spO2 were monitored at the interval of three minutes for first 30 minutes and fifteen minutes after that.

All proceedings in which patients were subjected to were routine and performed in order to achieve better therapeutic approach to the patients. All data was analyzed using statistical package for social science (SPSS) version 19.

RESULTS

Out of the total 100 patients included in the study, 50 in group I received 0.5% hyperbaric bupivacaine while remaining 50 in group II received 0.75% hyperbaric bupivacaine for intrathecal anesthesia for elective Caesarean section. Both groups were comparable in terms of age ($p>0.05$), weight ($p>0.05$), height ($p>0.05$), and duration of surgery ($p>0.05$) [Table I].

The above table shows the demographic data for groups; mean and standard deviation for each variable was

TABLE I: DEMOGRAPHIC DATA OF PATIENTS RECEIVING HYPERBARIC BUPIVACAINE FOR INTRATHECAL ANESTHESIA (MEAN±SD)

Variables	Group I (0.5% hyperbaric bupivacaine)	Group II (0.75% hyperbaric bupivacaine)	P value#
Age (years)	29.8±4.8	31.7±5.1	>0.05
Weight (kg)	70.6±6.4	68.2±6.2	>0.05
Height (cms)	154.70±5.53	157.07±4.98	>0.05
Duration of surgery (mins)	49.2±7.2	49.3±7.4	>0.05

t-Test

TABLE II: FINDINGS OF INTRAOPERATIVE CARDIOVASCULAR MONITORING IN PATIENTS RECEIVING HYPERBARIC BUPIVACAINE FOR INTRATHECAL ANESTHESIA#

Variables	Group I (0.5% hyperbaric bupivacaine)	Group II (0.75% hyperbaric bupivacaine)	P value$
Baseline SBP	129.13±12.75	130.88±13.14	>0.05
SBP at 0 min	128.00±10.00	131.00±11.00	>0.05
SBP at 03 min	108.30±22.16	112.33±21.27	>0.05
SBP at 09 min	113.91±18.09	115.30±14.49	>0.05
MAP at 0 min	96.70±9.00	97.00±6.00	>0.05
MAP at 03 min	81.19±17.41	82.37±15.40	>0.05
MAP at 09 min	86.03±12.66	83.94±13.37	>0.05
HR at 0 min	102.27±15.56	103.47±15.34	>0.05
HR at 03 min	101.50±19.64	103.57±22.00	>0.05
HR at 09 min	96.23±19.23	94.99±16.79	>0.05

#Values are expressed as Mean±SD; $ t-Test, SBP=systolic blood pressure in mmHg, MAP=mean arterial pressure in mmHg, HR=heart rate per minute.

TABLE III: COMPARISON OF OUTCOME VARIABLES OF PATIENTS RECEIVING HYPERBARIC BUPIVACAINE FOR INTRATHECAL ANESTHESIA

Variables		Group I (0.5% hyperbaric bupivacaine)	Group II (0.75% hyperbaric bupivacaine)	P-value#
Block level	T4	39 (78%)	25 (50%)	<0.05
	T6	11 (22%)	25 (50%)	
Uneasiness/discomfort	Yes	0 (0%)	24 (48%)	<0.05
	No	50 (100%)	26 (52%)	
Nausea/Vomiting	Yes	0%	34%	<0.05
	No	100%	66%	

#Chi Square test

calculated and p value was calculated using independent sample t-test which showed non significant result.

The volume of hyperbaric bupivacaine 0.5% is 2.1ml in group I whereas in group II 1.4ml of 0.75% hyperbaric bupivacaine was given. The hemodynamic parameters were comparable in two groups. There was no significant difference between heart rate and fall in blood pressure in both the groups (Table II).

Percentages were calculated for level of block, uneasiness/discomfort, nausea and vomiting as shown in Table III. Their values between the groups were compared using Chi Square test that showed significant result. The block level of T4 was achieved by 39 (78%) patients in group I while by 25 (50%) patients in group II. The frequency of uneasiness and discomfort was less in group I as compare to group II ($p<0.05$) while nausea and vomiting was also less in group I as that of group II ($p<0.05$).

DISCUSSION

In our study, both 0.5% and 0.75% hyperbaric bupivacaine produced adequate spinal anesthesia for elective Caesarean section. Some studies have stated that doses less than 10mg carry a substantial risk of inadequate block during caesarean section, thus necessitating supplementary analgesia because of visceral pain during surgery.[9,10] In this study we used 10.5mg of bupivacaine with different concentrations. Clinical effects associated with bupivacaine like time to sensory analgesia, highest sensory analgesia level, inadequate block, duration of analgesia and complications are thought to be direct effects of the local anesthetic present in the subarachnoid space.[11] The time to T4 sensory analgesia in our study was 6.89 ± 0.82 minutes in group I and 6.23 ± 0.46 minutes in group II. Some studies have concluded that adding an adjunct to hyperbaric bupivacaine shortens the time to achieve the highest sensory level.[12,13] Hyperbaric bupivacaine redistributes to the dependent area of the subarachnoid space and is thus drawn cephalad into dependent thoracic kyphosis to pool down to lowest part of thoracic curvature, situated around T4-5.[14] The movement of the hyperbaric drug is unaffected by the lumbar interspace chosen for subarachnoid injection. In pregnant patients the factors effecting distribution of the local anesthetic solution in cerebrospinal fluid depends on the height of the patient, anatomy of spine, volume and baricity of local anesthetic solution and the position of the patient. Altered cerebrospinal fluid dynamics associated with caval compression, epidural venous engorgement and positional changes play a major role in promoting the cephalad redistribution of bupivacaine. Both 0.5% and 0.75% bupivacaine produced adequate block as the requirement of supplemental intraoperative analgesic was not significantly different in them.

Several different mechanisms may play a role in causing post-operative nausea and vomiting (PONV) in patients who receive regional anesthesia. In a retrospective analysis, Crocker and Vandam16 found that hypotension (systolic blood pressure < 80 mmHg), a block higher than the fifth thoracic segment, and the anesthetic mixture (e.g. addition of vasoconstrictors to the local anesthetic) increased the incidence of nausea and vomiting during spinal anesthesia. The prospective work of Carpenter et al in a similar setting confirmed this findings.[17] It appears that not one single mechanism is responsible for causing PONV. Several mechanisms may be active simultaneously, and the importance of each in a particular case may remain speculative. The reported incidence of PONV associated with spinal anesthesia varies widely. Carpenter et al studied 952 patients undergoing all types of procedures.[17] They found an intraoperative rate of nausea of 18% and vomiting of 7%. In our study we tried to compare the incidence of this complication using different concentrations of bupivacaine and found out that lower concentration of the drug leads to lesser incidence which was in contrast to the findings of Solakovic N.[6]

CONCLUSION

In our study hemodynamic parameters in both groups showed no significant difference. However, patients administered with 0.5% hyperbaric bupivacaine for lower segment caesarean section showed more appropriate levels of block, less incidence of nausea and vomiting, and more patient comfort as compared to 0.75% hyperbaric bupivacaine.

LIMITATIONS OF STUDY:

The dose which is 10.5 mg and baricity was kept constant while studying the two different concentrations of 0.5% and 0.75% of bupivacaine. The only limitation was the volume of the drug injected that can't be equalized in order to keep the same dosage.

REFERENCES

1. Solakovic N. Comparison of hemodynamic effects of hyperbaric and isobaric bupivacaine in spinal anesthesia. Med Arh 2010;64:11-14.
2. Jabalamelli M, Hazegh N, Gholami S. The effects of hyperbaric or isobaric bupivacaine on bispectral index in spinal anesthesia for cesarean section. J Res Med Sci 2012;17:176-81.
3. Gupta R, Bogra J, Singh PK, Saxena S, Chandra G, Kushwaha JK. Comparative study of intrathecal hyperbaric versus isobaric ropivacaine: A randomized control trial. Saudi J Anesthesia 2013;7:249-53.
4. D'Ambrosio A, Spadaro S, Mirabella L, Natale C, Cotoia A, De Capraris A, et al. The anesthestic and recovery profile of two concentrations (0.25% and 0.5%) of intrathecal isobaric levo bupivacaine for combined spinal and epidural anesthesia in patients undergoing modified Stark method caesarean delivery: a double blinded randomized trial. Eur Rev Med Pharmacol Sci 2013;(17):3229-36.
5. Sia AT, Tan KH, Sng BL, Lim Y, Chan ES, Siddiqui FJ. Use of hyperbaric versus isobaric bupivacaine for spinal anesthesia for caesarean section. Cochrane Database Syst Rev 2013:31;5:1-42.
6. Solakovic N. Level of sensory block and baricity of bupivacaine 0.5% in spinal anesthesia. Med Arh 2010;64:158-60.
7. Loubert C, Hallworth S, Fernando R, Columb M, Patel N, Sarang K, et al. Does the baricity of bupivacaine influence intrathecal spread in the prolonged sitting position before elective cesarean delivery? A prospective Randomized Controlled Study. Anesth Analg 2011;113:811-17.
8. Punshi GD, Afshan G, Spinal Anaesthesia for Caesarean section: plain vs hyperbaric bupivacaine. J Pak Med Assoc 2012;62:807-11.
9. Chung CJ, Bae SH, Chae KY, Chin YJ. Spinal anesthesia with 0.75% hyperbaric Bupivacaine for ceasarean section: Effect of volume. Br J Anesth 1996;77:145-9.
10. Chan V, Peng P, Chinyanga H, Lazarou S, Weinbren J, Kaszas Z. Determining minimum effective anesthetic concentration of Hyperbaric Bupivacaine for spinal anesthesia. Anesth Analg 2000;90:1135-40.
11. Martin R, Frigon C, Chretien A, Tétrault JP. Onset of spinal block is more rapid with isobaric than hyperbaric bupivacaine. Can J Anesth 2000;47:43-6.
12. Bano F, Sabbar S, Zafar S, Rafeeq N, Iqbal MN, Haider S, et al. Intrathecal fentanyl as adjunct to hyperbaric bupivacaine in spinal anesthesia for cesarean section. J Coll Physicians Surg Pak 2006;16:87-90.
13. Parlow JL, Phyllis M, Philip C, Jemifer R, Brian M. Addition of opioid alter the density and spread of intrathecal local anesthetic? A vitro study. Can J Anesth 1999;46:66-70.
14. Huabayashi Y, Shimizu R, Saitoh K, Fukuda H, Igarashi T, Furuse M. Anatomical configuration of the spinal column in the supine position: Comparison of adolescent and adult volunteer. Br J Anesth 1996;76:508-10.
15. Arndt JO, Bomer W, Krauth J, Marquardt B. Incidence of time course of cardiovascular side effects during spinal anesthesia after prophylactic administration of intravenous fluid or vasoconstrictor. Anesth Analg 1998;87:347-54.
16. Crocker JS, Vandam LD. Concerning nausea and vomiting during spinal anesthesia. Anesthesiology 1959;20:587-92.
17. Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anesthesia. Anesthesiology 1992;76:909-16.

CONFLICT OF INTEREST

Authors declared no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE

NIL

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

QUAA: Concept & study design, acquisition analysis and interpretation of data, drafting the manuscript, final approval of the version to be published

AS & AK: Drafting the manuscript, critical revision, final approval of the version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

KMUJ web address: www.kmuj.kmu.edu.pk

Email address: kmuj@kmu.edu.pk