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Comparison of Onset of Sensory Block after Intrathecal use of Hyperbaric and Isobaric Bupivacaine in Non-Obstetric Patients

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ABSTRACT

Background: Spinal anesthesia is commonly used in the lower limb and lower abdominal surgeries and bupivacaine is the drug used intrathecally. Bupivacaine is available in two forms isobaric having density same as CSF and hyperbaric having greater density than CSF. **Objective:** This study was performed to see the difference of onset of sensory block after intrathecal use of hyperbaric versus isobaric bupivacaine in non-obstetric patients. **Study Design:** This randomized control trial. **Settings:** Study was conducted in Pakistan Institute of Medical Sciences, Islamabad Pakistan. **Duration:** Six months from January 2020 to June 2020. **Methods:** Total 60 patients undergoing lower abdominal surgeries 25 to 50 years of either gender were included. The patients were randomized either intrathecal isobaric bupivacaine for group I or hyperbaric bupivacaine for group H to compere the time for onset of sensory block. Data collection was done by the study proforma and analysis was done by using the SPSS version 26. **Results:** Age range of the subjects was 25 to 50 years with overall average age of 37.61 ± 5.03 years. Out of total 60 patients 15 males and 45 were females and the ratio was 1:3. An average onset time for group H was significantly shorter 2.02 ± 0.85 in group H (hyperbaric bupivacaine) versus 5.53 ± 1.14 minutes with group I (isobaric bupivacaine) (p- 0.001). **Conclusion:** Study concluded that the use of intrathecal hyperbaric bupivacaine has rapid onset of sensory block at the T_{10} level compared to the Isobaric bupivacaine of sensory block.

Keywords: *Spinal anesthesia, Sensory block, Hyperbaric bupivacaine, Isobaric bupivacaine.*

INTRODUCTION

A secure anesthetic method utilized for both elective and urgent procedures is spinal anesthesia (SA),[1] specially for surgeries of lower abdomen and lower extremities or where general anesthesia is contraindicated. Injection of a substance known as local anesthetics in the epidural or subarachnoid space to block appropriate spinal nerve roots,[2] which have anesthetic effects on the spinal anesthesia in scheduled lower extremity orthopedic operations.[2,3]

The best local anesthetic for intrathecal use has a quick onset, consistent duration, and a lower occurrence of the side effects.[5] Currently the most popular local anesthetic for spinal anesthesia is bupivacaine (SA).[6] Bupivacaine is commercialized in two different forms: hyperbaric bupivacaine (HB), which has a density stronger than cerebrospinal fluid, and isobaric bupivacaine (IB), which has the particular density or gravity equivalent to cerebrospinal fluid.[6]

The pattern of diffusion that defines the effectiveness, distribution, and side-effect is thought to be impacted by the variation in densities between the two commercially available preparations.[6] The recently developed anesthetic ropivacaine is 40% less effective than bupivacaine.[7] Spinal anesthesia made hyperbaric with ropivacaine and dextrose is reported to be effective.[7]

As in preliminary investigations, isobaric ropivacaine's effectiveness and safety for neuraxial blockade were assessed.[7,8] When compared to intrathecal lignocaine, intrathecal ropivacaine has been observed to be less likely

to cause transient neurological symptoms (TNS) and to activate with a shorter half-life than bupivacaine.[7,9] Due to the predictable block properties hyperbaric LA has grown in popularity.[7,10]

Concerning the predictability of analgesic levels attained with isobaric solution in comparison to hyperbaric, there is debate.[5,11] The vast majority of local anesthetics used for spinal anesthesia are accessible as solutions of hyperbaric, and it is widely known that adding dextrose to make the solutions more specific gravity changes their anesthetic characteristics.[5,12] This study has been done to determine the difference of onset of sensory block after intrathecal use of hyperbaric versus isobaric bupivacaine in non-obstetric patients.

METHODS

This randomized control trial was conducted in Pakistan Institute of Medical Sciences Islamabad, Pakistan during a period of Six months from January 2020 to June 2020.

After receiving the ethical approval from the hospital's ethical committee, each patient signed a written informed consent form that fulfilled the inclusion criteria (patients planned for lower limb and lower abdominal surgeries ASA I and II, age between 25 and 50 years and both genders).

All those patients with high BMI, intraabdominal mass, spinal deformity and local skin infection were excluded.

Before the procedure, the participants underwent a pre-anesthesia evaluation. Participants were split into two groups at randomly. Group H for hyperbaric and group I for isobaric bupivacaine. Monitoring was non-invasive ECG, blood pressure and pulse oximetry. Intravascular access was maintained with 18 G I/V cannula. Baseline vitals were taken. Patients were randomly divided into 2 groups, group H and group I.25 G Quincke needle was used and dose of 15 mg of 0.5% and 0.75% bupivacaine was given randomly in L_2, L_3 interspace over 15 seconds. The tip of needle is kept cephalic. The patient is divided into randomly by using lottery method.

Group I: Patients who were receiving Isobaric bupivacaine. Group H: Patients who are receiving hyperbaric bupivacaine.

Patient were kept in supine position, after injecting the drug stopwatch was started immediately and time for onset of sensory block was evaluated by the pin prick with blunt 27 G needle around umbilicus. The time was noted after every 1 minute till the block for T_{10} established. The time for sensory block was measured for both concentrations of bupivacaine. The outcome is measured by comparing the onset time of sensory block of both drugs. Data was collected using the study proforma, and SPSS version 26 was used for analysis.

RESULTS

The patients were in age ranged from 25 to 50 years with overall average of 37.61 ± 5.03 years. Particularly the average age of the group H patients was 37.67 ± 5.29, while in group I was 37.50 ± 4.85 years. Out of 60 patients 15 males and 45 were females and the ratio was 1:3. According to the ASA status 13(43.33%) were found with status I and 17(56.67%) were with status II in group H, while 12(40.0%) with status I and 18(60.0%) were with status II in group I. Types of surgeries were also presented in table 1.

Table 1: Descriptive statistics of demographic variables (n=60)

Variables		Study Groups		Total (n=60)
		Group H (n=30)	Group I (n=30)	
Age		37.67 ± 5.29 years	37.50 ± 4.85 years	37.61 ± 5.03 years
ASA status	I	13 (43.33%)	12 (40.0%)	25 (41.67%)
	II	17 (56.67%)	18 (60.0%)	35 (58.33%)
Types of surgical procedures	Urology	10 (33.33%)	09 (30.0%)	19 (31.67%)
	Orth & General Surgery	11 (36.67%)	09 (30.0%)	20 (33.33%)

Group I: Isobaric bupivacaine, Group H: Hyperbaric bupivacaine

Average of the onset time duration for group H was 2.02 ± 0.85 in group H (hyperbaric bupivacaine) verses 5.53 + 1.14 minutes with group I (isobaric bupivacaine) (p-0.0001). Mean time of onset was statistically significant with respect to the age, gender and ASA status p-values were quite significant (p-<0.05). Table 2

Table 2: Comparison of the mean time for onset of sensory block in both groups, as well as with respect to the age, gender and ASA status (n=60)

Variables		Study groups		P-value
		Group H (n=30)	Group I (n=30)	
Time of Onset (average)		2.20 ± 0.85 minutes	5.53 ± 1.14 minutes	0.0001
Mean time for onset with respect to age groups	25-40 years	2.22 ± 0.81 minutes	5.28 ± 1.23 minutes	0.0001
	41-50 years	2.17 ± 0.94 minutes	5.92 ± 0.90 minutes	0.0001
Gender	Male	2.38 ± 0.92 minutes	4.86 ± 1.21 minutes	0.0001
	Female	2.14 ± 0.83 minutes	5.74 ± 1.05 minutes	0.0001
ASA status	I	2.15 ± 0.90 minutes	5.25 ± 1.06 minutes	0.0001
	II	2.24 ± 0.83 minutes	5.72 ± 1.18 minutes	0.013

Group I: Isobaric bupivacaine, Group H: Hyperbaric bupivacaine

DISCUSSION

Study has been done to compare the onset of mean time for sensory block after intrathecal use of bupivacaine isobaric and hyperbaric solution. In this study an average age of the study participants was 37.61 ± 5.03 years, with age range from 25 to 50 years. Particularly both patient groups H and I had mean ages of 37.67 ± 5.29 and 37.50 ± 4.85 years, respectively.

Most of the study subjects 36(60.0 %) were between 25 to 40 years of age. Out of these 15 (25.0 %) were males 45 (70.0 %) were female and male and female ratio was 1:3. In this study the mean time of onset 2.20 ± 0.85 in group H (Hyperbaric Bupivacaine) verses 5.3 ± 1.14 minutes in group I (isobaric bupivacaine) with p value 0.0001.

One study showed the time required to achieve the T_{10} sensory block with hyperbaric bupivacaine was 1.1 ± 0, 32 min as compare to isobaric 4.7 ± 2.9 min with p value of 0.0015. In another study the onset of sensory block 4.8 ± 2.2 with a p value of 0.0014. In another study Souter KJ *et al*[15] studied the location and size of the intra-thecal bupivacaine distribution. The patients received a combination spinal epidural injection containing 10 mg of hyperbaric, isobaric, or hypobaric bupivacaine in either a sitting or right lateral posture. When seated, hypobaric bupivacaine produced a greater T2 sensory block than hyperbaric bupivacaine. Less motor blockage was formed as basicity rose. For both hyperbaric T3 and the median sensory level of T2 in the L3,4 area, an isobaric combination was administered. In contrast to the hyperbaric and hypobaric mixture 100, the isobaric is unaffected by posture.

Another study examined lower abdominal procedures using isobaric and hyperbaric anesthesia. In contrast to our study, which showed that hyperbaric bupivacaine has a faster beginning of action and longer analgesia, when 20 mg of bupivacaine was administered without any additives, the onset of block was quicker with isobaric bupivacaine and the length of analgesia was prolonged with isobaric.[16] The findings were nearly identical to ours in a Cochrane study that compared six studies in 394 individuals receiving intra thecal hypo and hyperbaric bupivacaine. Hyperbaric bupivacaine caused a sustained analgesia with a rapid onset of sensory suppression. Another study utilized 25 mice and 10 mg of bupivacaine. There were statistically significant differences in the time it took to attain the maximum T4 level and the beginning of sensory blockage.[17] Contrary to our findings, however, isobaric bupivacaine took more time and led to a protracted period in 2 dermatomes sensory level regression T4, whereas hyperbaric medication had a longer length of blockage.

CONCLUSION

This study concluded that the hyperbaric bupivacaine has rapid onset of T_{10}sensory block as compare to isobaric bupivacaine. So, the recommendation is to use hyperbaric bupivacaine for spinal anesthesia to achieve the T_{10} sensory block.

LIMITATIONS

In this study sample size was small and study was based on only one center.

SUGGESTIONS / RECOMMENDATIONS

Hyperbaric Bupivacaine must be available in Gynae and Obstetrics setups.

CONFLICT OF INTEREST / DISCLOSURE

No conflict of interest.

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REFERENCES

1. Esmat IM, Mohamed MM, Abdelaal WA, El-Hariri HM, Ashoor TM. Postspinal anesthesia shivering in lower abdominal and lower limb surgeries: a randomized controlled comparison between paracetamol and dexamethasone. BMC Anesthesiol. 2021 Oct 30;21(1):262.
2. Zhang X, Dong Q, Fang J. Impacts of General and Spinal Anaesthesia on Short-Term Cognitive Function and Mental Status

in Elderly Patients Undergoing Orthopaedic Surgery. J Coll Physicians Surg Pak. 2019 Feb;29(2):101-104.
3. Rocchi R, Lombardi C, Marradi I, Di Paolo M, Cerase A. Intracranial and intraspinal hemorrhage following spinal anesthesia. Neurol Sci. 2009 Oct;30(5):393-6.
4. Lee KK, Lee MY, Han DY, Jung HJ, Joo MC. Effects of bladder function by early tamsulosin treatment in a spinal cord injury rat model. Ann Rehabil Med. 2014 Aug;38(4):433-42.
5. Helmi M, Uyun Y, Suwondo BS, Widodo U. Comparison of intrathecal use of isobaric and hyperbaric bupivacaine during lower abdomen surgery. Journal of Anesthesiology. 2014 Feb 5;2014.
6. Uppal V, Shanthanna H, Prabhakar C, McKeen DM. Intrathecal hyperbaric versus isobaric bupivacaine for adult non-caesarean-section surgery: systematic review protocol. BMJ Open. 2016 May 18;6(5):e010885.
7. Kulkarni KR, Deshpande S, Namazi I, Singh SK, Kondilya K. A comparative evaluation of hyperbaric ropivacaine versus hyperbaric bupivacaine for elective surgery under spinal anesthesia. J Anaesthesiol Clin Pharmacol. 2014 Apr;30(2):238-42.
8. Wahedi W, Nolte H, Klein P. Ropivacain zur Spinalanästhesie. Eine Dosisfindungsstudie [Ropivacaine for spinal anesthesia. A dose-finding study]. Anaesthesist. 1996 Aug;45(8):737-44. German.
9. Zaric D, Christiansen C, Pace NL, Punjasawadwong Y. Transient neurologic symptoms after spinal anesthesia with lidocaine versus other local anesthetics: a systematic review of randomized, controlled trials. Anesth Analg. 2005 Jun;100(6):1811-1816.
10. Fettes PD, Hocking G, Peterson MK, Luck JF, Wildsmith JA. Comparison of plain and hyperbaric solutions of ropivacaine for spinal anaesthesia. Br J Anaesth. 2005 Jan;94(1):107-11.
11. Martin R, Frigon C, Chrétien A, Tétrault JP. Onset of spinal block is more rapid with isobaric than hyperbaric bupivacaine. Can J Anaesth. 2000 Jan;47(1):43-6.
12. Solakovic N. Level of sensory block and baricity of bupivacaine 0.5% in spinal anesthesia. Med Arh. 2010;64(3):158-60.
13. Hidayah MN, Liu CY, Joanna OS. Ketamine and tramadol for the prevention of shivering during spinal anaesthesia. Clin Ter. 2014;165(4):193-8.
14. Lakhe G, Adhikari KM, Khatri K, Maharjan A, Bajracharya A, Khanal H. Prevention of Shivering during Spinal Anesthesia: Comparison between Tramadol, Ketamine and Ondansetron. JNMA J Nepal Med Assoc. 2017 Oct-Dec;56(208):395-400.
15. Souter KJ, Pittaway AJ, Barash PG, Cullen BF, Stoelting RK, Cahalan MK, Stock MC, Ortega R. Nonoperating room anesthesia (NORA). Clinical Anesthesia. 7th edition. Philadelphia: Lippincott Williams and Wilkins. 2013:885-6.
16. Helmi M, Uyun Y, Suwondo BS, Widodo U. Comparison of intrathecal use of isobaric and hyperbaric bupivacaine during lower abdomen surgery. J Anesthesiol. 2014 Feb;10:1155-10.
17. Sia AT, Tan KH, Sng BL, Lim Y, Chan ES, Siddiqui FJ. Use of hyperbaric versus isobaric bupivacaine for spinal anaesthesia for caesarean section. Cochrane Database Syst Rev. 2013 May 31;(5):CD005143.