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Original Research Article

Spinal Anaesthesia for Trans-Urethral Resection of Prostate; A Comparative Study Between Hyperbaric Solutions of Levo-Bupivacaine and Ropivacaine in Patients Between Age Group of 50-70 Years

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Abstract

Introduction: Benign prostatic hyperplasia is very common in males in their 5th-7th decade of life. Old age is associated with various comorbidities including cardiopulmonary diseases. Spinal anesthesia induced by racemic bupivacaine further aggravates this problem increasing their susceptibility to hypotension and bradycardia, levobupivacaine is known for its safer hemodynamic profile and has a low incidence of cardiotoxicity and neurotoxicity in case of accidental intravascular administration, whereas ropivacaine is associated with short duration of action and aids in early mobilization. Intraoperative complications like shock, TURP syndrome and LAST are difficult to diagnose clinically therefore hemodynamic stability and prevention of LAST becomes a matter of utmost importance in trans urethral resection of prostate. Therefore, our study was structured for comparison of the sensory and motor block achieved with intrathecally administered 0.5% hyperbaric bupivacaine with 0.75% hyperbaric ropivacaine.

Aim: The primary objective of our study was comparison of adequacy and duration of sensory and motor block achieved by intrathecal administration of hyperbaric levobupivacaine with hyperbaric ropivacaine. The secondary objective of our study was to compare the safety profile of both the drugs.

Material and Methods: 60 consenting males belonging to ASA I and ASA II category aged between 50-70 years undergoing elective trans-urethral resection of prostate under spinal anaesthesia were selected, and randomly assigned to either, group L or group R by closed envelop method, patients belonging to group L were injected with 2.5 ml 0.5% heavy levobupivacaine whereas patients belonging to group R were injected with 2.5 ml 0.75% heavy ropivacaine. Patients were assed for onset and regression of levels of sensory block and motor block and the hemodynamic stability and side effects of both the drugs.

Result: Both groups were comparable in terms of mean time to onset of the sensory block at T10, the extent of spread & time to achieve maximal sensory block. The regression of sensory block was observed to be more rapid in the ropivacaine group compared to levobupivacaine

group, as observed in the findings of duration at T10 and the overall duration of sensory block. Patients belonging to ropivacaine group demonstrated a rapid recovery from motor block and were able to mobilize early compared to levobupivacaine group. A similar incidence of side effects was observed in both groups.

Conclusions: Intrathecal administration of hyperbaric ropivacaine provides adequate anaesthesia which lasts for a shorter duration compared to levobupivacaine which can be utilized in patients requiring early ambulation. Safety profile of both the drugs are observed to be comparable.

Keywords: TURP (trans-urethral resection of prostate), Levobupivacaine, Ropivacaine, Spinal aesthesia.

Introduction

Benign prostatic hyperplasia is very common in elderly males in their 5th-7th decade of life therefore these patients are more likely to be suffering from cardiopulmonary diseases. Therefore limiting the level of the block to the desired level and reduction of adverse cardio-pulmonary effects becomes even more important.[1]

Spinal anesthesia is considered to be better than general anaesthesia in endoscopic urological surgeries since we are able to timely recognise bladder perforation and the symptoms of TURP syndrome caused by overhydration and dilutional hyponatraemia.[2] Spinal anaesthesia causes peripheral pooling of blood and counters the circulatory overload, it also reduces the incidence of deep vein thrombosis as well as provides post-operative pain relief and decreases the requirement of opioids in the post-operative period. Spinal anaesthesia avoids the need for endotracheal intubation avoiding the laryngoscopy associated pressor response, laryngeal oedema, and post-operative cough which may lead to increased bleeding from surgical site and delayed ambulation.

Post spinal hypotension and delayed ambulation are the two major drawbacks of spinal anaesthesia in old age patients with pre-existing cardiac diseases, systemic vascular resistance may drop by 25% compared to 15-18% in healthy patients.[3]This hypotension is treated with liberal use of intravenous fluids or vasopressors, which can prove hazardous in elderly patients with cardiopulmonary diseases.

Both ropivacaine and levobupivacaine have been evaluated for successful administration of spinal anaesthesia. Levobupivacaine (S (-) enantiomer of racemic bupivacaine) exhibits low cardiotoxicity and neurotoxicity.[4,5] Levobupivacaine is a better alternative to bupivacaine due to its better safety profile.[6]

Ropivacaine was found to have a shorter duration of action compared to bupivacaine, which makes it a possible alternative to lidocaine due to its low incidence of transient neurological symptoms.[7] Whereas levobupivacaine in comparison with racemic bupivacaine produces a similar block.[8]

Keeping the above background in mind this study was designed to compare the adequacy and duration of sensory and motor block achieved by intrathecal administration of hyperbaric levobupivacaine with hyperbaric ropivacaine. The secondary objective of our study was comparison of the safety profile of both the drugs.

Material and Methods

This was a prospective, double blinded study, conducted at a tertiary hospital associated with a medical college, 60 consenting males belonging to ASA I/II category aged between 50-70 years undergoing elective trans-urethral prostate resection under sub arachnoid block were selected, and randomly assigned to either, group L or group R by closed envelop method.

Inclusion criteria:

Age between 50-70 years, patients giving written informed consent, ASA I or II, no drug allergy to any of the study drugs, patients undergoing routine TURP surgeries under sub arachnoid block.

Exclusion criteria:

Patients suffering from arthritis or scoliosis or peripheral neuropathy, infection at injection sites, obese patients, patients with hypersensitivity to the study drugs or coagulation defects, ASA III or above patients, patient refusal, patients requiring general anaesthesia were not included in this study.

After reaching the operating room all patients were connected to routine monitoring devices and baseline readings of peripheral oxygen saturation, heart rate, non-invasive blood pressure were recorded and half liter of normal saline was connected through a 20 gauge intravenous canula inserted on dorsum of left hand. with all aseptic precautions a 25 gauge spinal needle (Quincke's type) was inserted at lumbar at L3-L4 inter-vertebral space, correct needle placement was confirmed by free flow of clear cerebro-spinal fluid, after confirming the needle location 2.5ml heavy 0.5% levobupivacaine was administered intrathecally to group L and 2.5ml heavy 0.75% ropivacaine was administered to patients belonging to group R. Patients were assed for onset and levels of sensory block & motor block every minute for next twenty minutes as well as regression of sensory block and the motor block & hemodynamic stability. Surgery was started after achieving T10 dermatomal level of sensor block . The level of Sensory block was assessed by pinprick method at midclavicular line bilaterally and the level of motor block was assessed by Bromage scale (0 = no motor block, 3 = complete block).

Time taken by sensory block to reach T10, maximum level that the sensory block achieved, depth of motor block, time taken by sensory block to reach T10, time of requirement of rescue analgesic and time of regression of motor block and duration of surgery were noted, all vital parameters were measured every minute for first 5 minutes then every five minutes till completion of surgery. All the patients were monitored for adverse effects like headache, shivering, nausea, bradycardia, vomiting, hypotension for next 24 hours, patients suffering from hypotension were treated with 200ml 09% normal saline if hypotension persisted further 6mg ephedrine was injected intravenously and all episodes of bradycardia were treated with 0.3mg intravenous atropine sulphate, all episodes of intra operative pain were treated with 1mcg/kg fentanyl.

Result

Demographics- Out of 60 patients, 30 patients in group L were administered with 2.5ml 0.5% heavy levobupivacaine intrathecally whereas patients in group R were administered with 2.5ml 0.75% ropivacaine. Both the groups were demographically similar.

Table 1: Comparison Of Demographic Characteristics Between Both The Groups.

Demographics	Group L (Levobupivacaine)	Group R (Ropivacaine)	P value
Age	63.53±6.08	64.02±5.24	0.739
Weight	68.72±8.20	67.33±7.29	0.490
Systolic Blood Pressure	130.37±10.81	132.28±11.43	0.509
Diastolic Blood Pressure	78.20±8.50	79.88±7.99	0.433
Heart Rate	76.91±8.82	75.20±8.62	0.451
ASAI: ASAII	21:09	18:12	0.589

Chi square test is applied. The result is not significant at $p < .05$.

All the blocks belonging to both the groups achieved adequate sensory and motor levels for surgeries. Both groups were statistically similar with respect to time of onset of analgesia assessed by pinprick [levobupivacaine (2–8), ropivacaine (2–8)] and maximum dermatomal level achieved [levobupivacaine (T7), and ropivacaine (T7)], or in time to achieve highest level of sensory block [levobupivacaine (16.7 ±4.5) and ropivacaine (13.9±3.8)] and duration of surgery. [levobupivacaine (75 ±13.3) and ropivacaine (73±12.9)]

The time of regression of sensory block to T10 level [levobupivacaine 86.8±14.7 and ropivacaine72.7±10.6] and complete regression[levobupivacaine 227.7±33 and ropivacaine 164±24] were shorter in ropivacaine group compared to levobupivacaine group. The pattern of sensory regression was observed to be similar in both groups. The magnitude of motor block was comparatively less in ropivacaine group in comparison with levobupivacaine group(Table II).

Therefore, patients belonging to ropivacaine group were able to mobilize early compared to levobupivacaine group. Both levobupivacaine and ropivacaine groups were statistically similar in motor block characteristics or time to independent mobilization.

Table 2: Comparison Of Onset, Duration, Levels, Regression Of Sensory Block And Motor Block Between Levobupivacaine Group Versus Ropivacaine Group.

Parameter	Group L (n=30) Levobupivacaine	Group R (n=30) Ropivacaine	P value
Time of onset of analgesia	2-8	2-8	1
Time to reach sensory block T10	9.2±3.6	8.2±2.7	0.228
Maximum sensory level achieved	T7-5	T7-5	1
Time taken to reach maximum sensory block	15.7±4.5	13.9±3.8	0.099
Time to two segment regression	86.8±14.7	72.7±10.6	0.0001
Duration of surgery	75±13.3	73±12.9	0.557
Motor block at end of surgery (Bromage I)	26	19	0.072
Time to complete regression of motor block	227±33	164±26	0.0001

Chi-square test is applied. The result is not significant at $p < .05$.

Cardiovascular changes were unremarkable between the groups., the incidence of minor side effects like headache, shivering, hypotension, bradycardia, nausea vomiting, was statistically not significant between both the groups.

Table 3: Comparison of safety profile of levobupivacaine group with ropivacaine group.

Parameter	Group L (n=30) Levobupivacaine	Group R (n=30) Ropivacaine	P value
Hypotension	3	1	0.612
Bradycardia	3	1	0.621
Nausea	2	2	1
Vomiting	1	1	1
Headache	2	2	1
Shivering	3	1	0.621

Chi square test is applied. The result is not significant at $p < .05$.

Discussion

The molecule of bupivacaine has an asymmetric carbon atom which leads to exhibition of stereo-isomerism, In the commercial preparation of bupivacaine, there is a 50:50 ratio- Levobupivacaine,

L(-) isomer, and dextro bupivacaine D (+) isomer. This preparation which contains both enantiomers is known as a racemic mixture.[9]

Local anaesthetics inhibit the sodium channels on neural membranes and cause loss of conduction on neural structure and a loss of sensory innervation. Local anaesthetic systemic toxicity results from accidental injection of local anaesthetic intravascularly, causing high levels of local anaesthetics in blood leading to high levels in central nerve system and cardiovascular system. They exhibit a directly negative inotropic effect on myocardial conduction leading to arrhythmias caused by repolarization of potassium, sodium, and calcium channels resulting in fatal ventricular arrhythmias such as ventricular tachycardia or ventricular fibrillation.[10]

Levobupivacaine and ropivacaine are long-acting new generation of local anaesthetic agents which can be used in patients who cannot tolerate hemodynamic instability caused by bupivacaine in order to prevent severe complications associated with local anaesthetic systemic toxicity as well as haemodynamic complications associated with administration of intrathecal bupivacaine. Both of these drugs are levo-rotatory isomers with less severe central nervous system toxicity & cardiovascular toxicity. levobupivacaine and ropivacaine both have a similar clinical profile compared to racemic bupivacaine though anesthetic potency of these three drugs are a bit different. (racemic bupivacaine > levobupivacaine > ropivacaine). But the decreased toxic-potential associated with levobupivacaine and ropivacaine advocates their use in patients susceptible to systemic toxicity associated with intravascular injection & accidental overdosing. (epidural or peripheral nerve blocks)[11,12]

With this background in mind designed our study to compare the effect of administration of 0.5% hyperbaric levobupivacaine intrathecally with 0.75% hyperbaric ropivacaine on motor block & sensory block and side effect profile of both drugs in male patients aged 50-70 years undergoing elective trans-urethral resection of prostate.

Both groups were similar with respect to demographic characteristics, both groups demonstrated comparable time of onset of analgesia assessed by pinprick, maximal dermatomal sensory block achieved [T7], or in time to achieve maximum upper sensory block level.

The times of regression of sensory block to T10 and complete regression of motor block were observed to be less in ropivacaine group in comparison with levobupivacaine group. The pattern of sensory regression was observed to be

similar in both groups. The magnitude of motor block was found to be significantly less in ropivacaine group in comparison with the levobupivacaine group.

Therefore, patients belonging to ropivacaine group were able to mobilize early compared to levobupivacaine group.

To summarise our observation- we observed ropivacaine to have a less potent motor effect and the magnitude of sensory-motor separation is more as compared with levobupivacaine, but despite these findings ropivacaine produces a reliable sensory block, which has been supported by similar observations in other studies.[13,14]

No evidence of late complications such as backache, transient neurological symptoms were noted in our study similar to previous studies of ropivacaine.[15,16,17]

Conclusions:

Intrathecal administration of hyperbaric ropivacaine provides adequate anaesthesia which lasts for a shorter duration compared to levobupivacaine which can be utilized in patients requiring an early ambulation. Safety profile of both the drugs are observed to be comparable.

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