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Original Research Article

Comparative Evaluation of Repeat Dose of Ropivacaine V/S Bupivacaine in Sub Arachnoid Block for Patients Having Previous History of Scorpion Bite

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Abstract:

In our routine practice, it was observed that there were incidents of failed spinal anaesthesia in patients with history of scorpion bite. The mechanism of action of local anaesthetics via sodium channels may have possible mutations which alter the response to local anaesthetics. Randomly selected 40 patients of either sex or age range 18-60 years, of physical status ASA I/II, were divided into two equal groups of 20 patients each, both the groups were given initial dose of 3.5 ml 0.5% bupivacaine heavy. The onsets of sensory and motor block and peaks of sensory and motor block were observed with pin prick method and bromage scale. After 15 mins, if the effect of block was not achieved then in patients of group R repeat dose of 2.5ml of 0.75% Ropivacaine heavy given in subarachnoid block and in patients of Group B repeat dose of 2.5 ml of 0.5% Bupivacaine heavy given and effect was compared and assessed. In Group R, time of onset of both sensory and motor blocks and time for the peaks of sensory and motor blocks were significantly prolonged. So, we conclude that effect achieved by Ropivacaine given as repeat dose in subarachnoid block is significantly prolonged in comparison to Bupivacaine given as repeat dose in patients with previous history of scorpion bite.

Keywords: Ropivacaine, Bupivacaine, Subarachnoid Block.

Introduction

Spinal anaesthesia is the commonest type of regional anaesthesia used for below umbilical surgeries. Sometimes, the effect of local anaesthetic drug was not achieved, not because of technical issues [1,2], but may be because of some mutational changes.[3] In our country, insect bite/scorpion bite was commonly seen in general population (especially in rural areas).

Local anaesthetic drugs usually work on sodium channel for their desired effect. And in case of scorpion bite, Local anaesthetic drug resistance occurs because of mutation occurs at the level of receptors associate with sodium channels [3]. Because of this mutation in sodium channels, atypical receptor site will generate and causes local anaesthetic drug resistance. Sometimes, genetic factors can also be the reason for LA resistance i.e. carrying a variant of the melanocortin-1 receptor (MC1R) gene, can lead to resistance to many anaesthetic agents like local anaesthetic drugs, inhalational anaesthetic agents etc [4-6].

With this background, we decided to conduct a study in which we compare two different local anaesthetic drugs (Ropivacaine and Bupivacaine) for below umbilical surgeries for individuals who previously had a history of scorpion bite, & compare their sensory & motor blockade levels.

Methodology

This Prospective, Observational study was conducted in LNMC & JK Hospital, Bhopal (M.P.). The duration of our study was 3 years from January 2020 to December 2023, in which we had taken 40 patients (with history of previously scorpion bite) who was posted for below umbilical surgeries under spinal anaesthesia. After taking permission from Institutional Ethical Committee, we had divided these patients into 2 groups. We

divided these 40 patients into 2 equal groups of 20 each (Group R and Group B), by using coin method. On the day of surgery, after taking Verbal & Written informed consent from the patients as well as after complete Pre-anaesthetic check-up, we transfer the patient in operation theatre. 2 wide bore cannulas were already taken & now all multi para monitors were connected like pulse oximeter, NIBP, Spo2, ECG etc. All base line vitals parameter were recorded & collected in observation sheet. Next we asked the patient to change his posture from supine to sitting position so as to give the sub arachnoid block.

In both the Groups (Group R & Group B), initially we gave 0.5% Bupivacaine heavy 3.5ml. The onset and peak of sensory and motor block were observed with pin prick method and bromage scale. After 15 mins, if desired effect of block was not achieved, then in patients of Group R, 2.5ml of 0.75% Ropivacaine heavy was given and in patients of Group B, 2.5ml of 0.5% Bupivacaine heavy was repeated and effect was assessed.

Sensory block was assessed by pin prick method with 24 gauze needle after every 30 seconds and onset of sensory block was defined as the time when patient couldn't feel the pain. Motor block was assessed with the bromage scale after every 30 seconds. We had defined the onset of motor block, when patient was not able to move his lower limbs.

The block was considered to be adequate when level of sensory/motor block of up to T6-T8 was achieved. Patients in whom desired effect is not achieved even after repeat dose of local anaesthetic drugs upto 20 mins, then general anaesthesia was administered. After the completion of surgery, all patients were transferred to post Anaesthesia Care Unit (PACU) for postoperative monitoring during first 24 hours.

Result

On comparing 2 groups, mean age was 41.2 years versus 44.9 years which was statistically non-significant. The mean gender comparison between 2 groups was also non-significant.

Now we will compare the anaesthetic drug between 2 groups on the basis of use of different local anaesthetic agents. In both the groups, first we gave 0.5% Bupivacaine heavy intra-thecally & after when we doesn't got the desired effect then we repeat the local anaesthetic drug solutions (In group B, we gave 0.5% Bupivacaine heavy & in group R, we gave 0.75% Ropivacaine heavy).

Table 1:

Desired Anaesthesia Effects	Group B (Bupivacaine)		Group R (Ropivacaine)	
	1st attempt	2nd attempt	1st attempt	2nd attempt
No. of patients having Sensory blockade	01	02	01	19
No. of patients having Motor blockade	00	01	01	19

On reviewing the above table, it is clearly explained that after repeat dose of intrathecally 0.75% Ropivacaine heavy (1st dose was 0.5% Bupivacaine heavy), we got the desired sensory & motor blockade in most of the patients. The duration of sensory blockade in group R after giving 0.75% Ropivacaine was 156.7 ± 5.7 mins. (which was statistically significant if we compare it with Group B second attempt). The duration of motor blockade was comparitivly less as sensory blockade. This was only 98.31 ± 0.5 mins (which was statistically significant). There was no complications as well as side effect on using 0.75% Ropivacaine intrathecally.

Discussion:

Scorpion bite is very commonly seen in our country & individuals encounter with harmless to harmful situations, on the basis of type of scorpion venom. Rare complications are Pain, Burning sensation at the site of bite, & Serious complications are Myocardial infarction, Acute Pulmonary Oedema, Cardiogenic Shock & even death.[7] When these patients posted for surgeries, they show resistance to different anaesthetic agents. Failed or partial effect of intra-thecal anaesthetic agent can be because of Operator related failure, Technique related failure or Equipment/Drug related failure.[8] Out of all 3, drug related failure is irreversible. And in case of drug failure, resistance is the most common cause of failure. Voltage gated sodium channel consist of 1 alpha & 2 beta subunits.

Alpha subunit involves 4 homologous domains & each domain consist of 6 segments.[9,10] Our local anaesthetic drug acts on sixth segment of 4th domain. So, if resistance occurs because of any mutational changes then local anaesthetic will not act on this receptor.[10] Scorpion venom is a weak base & a complex mixture (consist of salts, nucleotides, amines, enzymes, mucopeptides & neurotoxins etc), & acts on specific voltage gated sodium channel ions. There are various kinds of scorpion venom & few will act on alpha & beta subunits of sodium channels, therefore, only these will result in failure of local anaesthetic drug action on sodium channels.[11]

Bupivacaine is an amino amide local anaesthetic drug while ropivacaine is a piperidine-carboxamide based amide which is a pure S-enantiomer. Molecular modelling of local anaesthetic drug

binding with sodium channel has demonstrated the differences in the relative alignment of aromatic part of ropivacaine as compared to bupivacaine.

The aromatic part of ropivacaine aligns towards the outer side of sodium channel whereas the aromatic part of bupivacaine aligns towards the inner side of sodium channel.[12,13] This differential alignment of aromatic ring may contribute to the difference in resistance of 2 local anaesthetics caused by scorpion sting.

Resistance to intrathecal bupivacaine in patients with a history of scorpion sting, and postulated that scorpion toxin itself or the antibodies against the toxin are responsible for the development of resistance to intrathecal bupivacaine.[15]

This may be due to antibodies against scorpion venom that had accumulated with multiple scorpion bites.[15,16] Therefore, the difference in 3-dimensional structures of ropivacaine and bupivacaine may confer differences in activity of their enantiomers on the receptors may be the reason for the success of intra-thecal ropivacaine in patients with scorpion bites.[14]

In our study also, we didn't got the sensory and motor effect of intrathecal hyperbaric bupivacaine on patients with history of scorpion bite, but when we repeat the dose with intrathecal hyperbaric ropivacaine, we got the desired effect of sensory as well as motor blockade.

Conclusion

We concluded that Hyperbaric Ropivacaine when given as repeat dose in patients of scorpion bite with failed spinal anaesthesia, achieved adequate block as well as prolongation of sensory and motor block compared to hyperbaric bupivacaine.

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