

**Original Article**

## An Observational Study to Compare Effectiveness Between Intra-Thecal Hyperbaric Bupivacaine 0.5% Versus Hyperbaric Ropivacaine 0.5% In Patients with History of Scorpion Bite Posted for Below Umbilical Surgery Under Spinal Anaesthesia in A Tertiary Care Centre

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**OPEN ACCESS****ABSTRACT**

**Background-** In India, scorpion bite is more common in rural population. That led to spinal anaesthesia failure and conversion to general anaesthesia. In this study we are comparing intrathecal hyperbaric bupivacaine 0.5% with intrathecal hyperbaric ropivacaine 0.5% in spinal anaesthesia.

**Method-** Total 276 patients of ASA I and II, 20-60 years age, with history of scorpion bite divided in 2 equal groups of 138 each and given 3.5 ml bupivacaine (Group B) or 3.5 ml of ropivacaine (Group R) and sensory and motor effects noted.

**Result-** demographically both groups are comparable. Group R patients had satisfactory spinal anaesthesia effect compared to group B, only 10 patients had some effect, other 128 patients received general anaesthesia.

**Conclusion-** Intrathecal Ropivacaine 0.5% heavy is significantly effective with faster onset and longer duration of effect in patients with history of scorpion bite posted for below umbilical surgery.

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**INTRODUCTION**

In India, two significant poisonous scorpion species are *Buthus tamulus* (small red) and *Palamneus gravimanus* (large black), with *Mesobuthus tamulus* (Indian red scorpion) being the most lethal [1].

Scorpion stings are common in the region. Their venom contains neurotoxins that block sodium channels, leading to massive catecholamine release and severe complications [2].

Spinal anaesthesia, a widely used technique, can sometimes fail due to poor patient positioning, spinal abnormalities, injection errors, and inaccurate drug dosage [3]. Resistance to local anesthetics can occur via various routes and is an uncommon but recognized phenomenon, often attributed to unexplained failure of the drugs [4].

Local anesthetics work through sodium channels, and mutations in these channels may lead to resistance [5]. Interestingly, scorpion neurotoxins also act on sodium channels, suggesting a potential link between venom-induced reactions and anaesthesia resistance.

**METHOD**

Site of study - Dhiraj Hospital, SBKS MIRC, Sumandeep Vidyapeeth deemed to be university, Piparia, Vadodara, Gujarat. After excluding the ethical aspects, 276 patients (n=276) of either sex, in the age range of 20 and 60 years and American Society of Anaesthesiologists (ASA) physical status I and II were included in the study. All were registered and admitted patients for planned surgery under proposed spinal anaesthesia. Informed and written consent was obtained for the surgery and anaesthesia and for inclusion in the study.

The study period was between April 2025 and July 2025. Patients with one or more scorpion bites undergoing spinal anaesthesia with hyperbaric bupivacaine comprised the group Bupivacaine (Group B) compared to an equal number of second group Ropivacaine (Group R).

All patients were pre-operatively assessed and were scheduled to undergo various types of elective surgeries after 8 hours of NBM under spinal anaesthesia (hernioplasty, hysterectomy, hydrocoele repair, Freyer's prostatectomy, Proximal Femoral nailing, tibia-fibula nailing etc.).

In the operating room, A 18 G Intravenous cannula was inserted in a peripheral vein and an infusion of Lactated Ringer was started and preloaded 10 ml per kg. The standard monitoring (Electrocardiography, heart rate, non-invasive blood pressure and pulse oximeter) was implemented.

Spinal needle (23 gauze Quincke) was placed with the patient in the sitting position in the L3-L4 or L4-L5 intervertebral space and 3.5 ml (17.5 mg) of 0.5% bupivacaine heavy or 3.5 ml (17.5 mg) 0.5% ropivacaine heavy was injected over 10-15 s and barbotage was not carried out. The anaesthesiologist's experience varied between 6 months to 6 years.

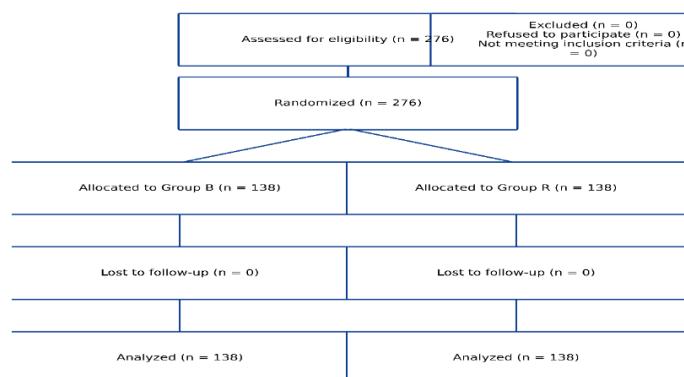
From this moment, the level of the **Sensory block will be evaluated by the Pin Prick method** and the **Motor block will be evaluated by Modified Bromage scale**.

Changes in Temperature, Pulse rate, systolic blood pressure, diastolic blood pressure, oxygen saturation & respiratory rate will be recorded at 0, 2, 5 minutes then at 10 minutes interval up to 30 minutes then every 15 minutes till the end of surgery then post operatively every 30 minutes till rescue analgesia.

The onset of sensory block was defined as the time when the patient could not feel the pain. The onset of motor block was considered as the time when patient could not flex the hip. The time of peak sensory and peak motor levels were considered when the maximum/upper most level of the block was achieved and there was no further progression of either the sensory or motor blockade, above that level.

The Anaesthesiologist who assessed the sensory and motor spinal blocks for all patients was blinded to the group of the patient. The assessment was performed as per proforma given. The block was considered to be adequate when level of sensory/motor block of up to T6-T8 was achieved. If after a 20 min period the block was not adequate, general anaesthesia was administered. At the end of surgery, all patients were transferred to surgical Intensive Care Unit for post-operative monitoring during the first 24 hours.

## RESULTS



### CONSORT CHART

Statistical Analysis of the data and application of various statistical tests were carried out with the help of Statistical Package for Social Services (SPSS). Data were compiled, analysed and presented as frequency, proportions, mean, standard deviation, the significance tests, percentages, independent sample *t*-test and paired *t*-test. A *P*<0.05 was considered as statistically significant. Continuous covariates (age) were compared using the independent sample *t*-test, with the *P* being reported at the 95% confidence interval. The results were expressed as Mean ± SD and *P*.

### Comparison of gender in both group

Gender	Male	Female	mean	
Bupivacaine	72	66	69	4.24 (SD), 1.95(P Value)
Ropivacaine	68	70	69	1.41
mean	70	68		1.41(SD)1.95(P Value)

This suggests that there is no significant difference in gender data in both groups.

**Comparison of patients' age data in both groups**

Age	GROUP R (ROPIVACAINE)	GROUP B (BUPIVACAINE)	P value
Years	40.19 ± 11.65	39.28 ± 11.83	0.5202

This suggests that there is no significant difference in age of both group's patients.

**Comparison of pre op vitals in both groups**

Vitals	GROUP R (ROPIVACAINE)	GROUP B (BUPIVACAINE)	P Value
Heart rate per min	79.26 ± 9.50	76.47 ± 11.21	0.0265
Systolic blood pressure mm Hg	126.55 ± 10.15	127.44 ± 9.47	0.4520
Diastolic blood pressure mm Hg	78.94 ± 5.69	80.87 ± 5.58	0.0048

This suggests that there is no significant difference in pre op vitals data.

**Comparison of sensory block achieved in both groups**

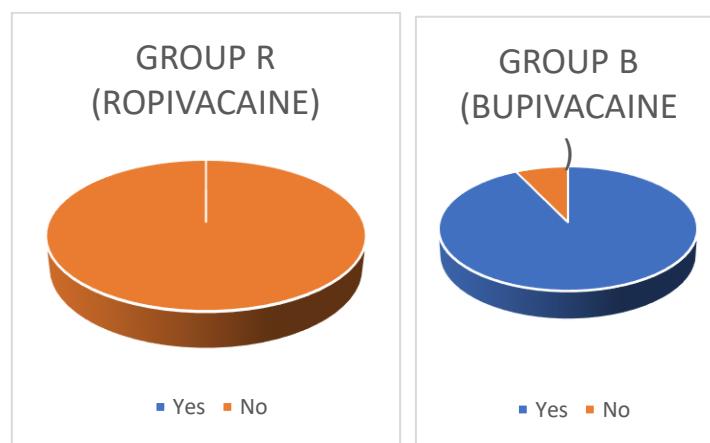
	GROUP R (ROPIVACAINE)	GROUP B (BUPIVACAINE)	P Value
TIME OF ONSET L1 (MIN)	5.83 ± 0.55	7.90 ± 0.99	< 0.0001
TIME OF T10 (MIN)	7.65 ± 0.54	18.68 ± 2.74	< 0.0001
TIME ACHIEVE HIGHEST LEVEL	10.86 ± 0.56	28.36 ± 5.85	< 0.0001
2 SEGMENT REGRESSION (MIN)	94.93 ± 2.68	87.27 ± 19.35	< 0.0001
TOTAL DURATION (COMPLETE REVERSAL)	234.76 ± 23.84	138.81 ± 26.99	< 0.0001

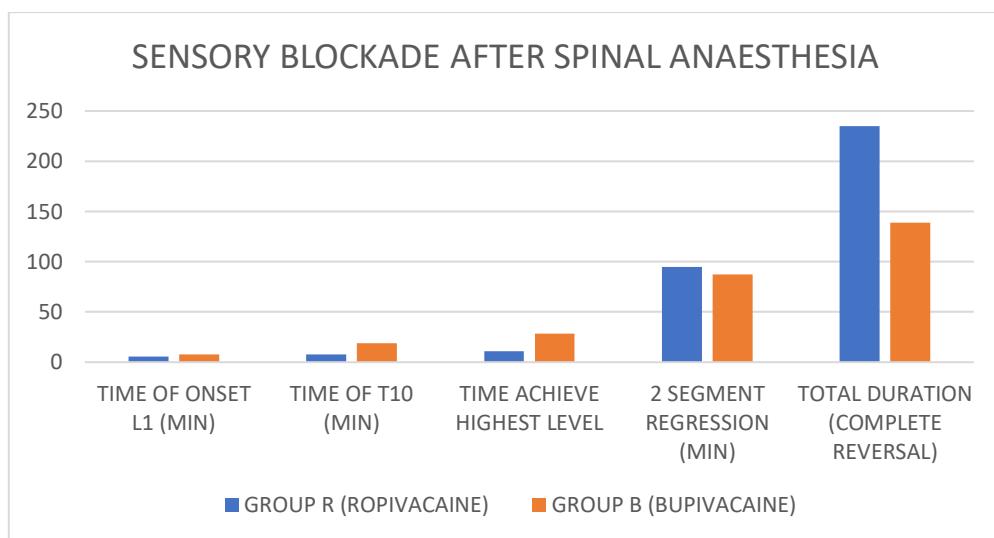
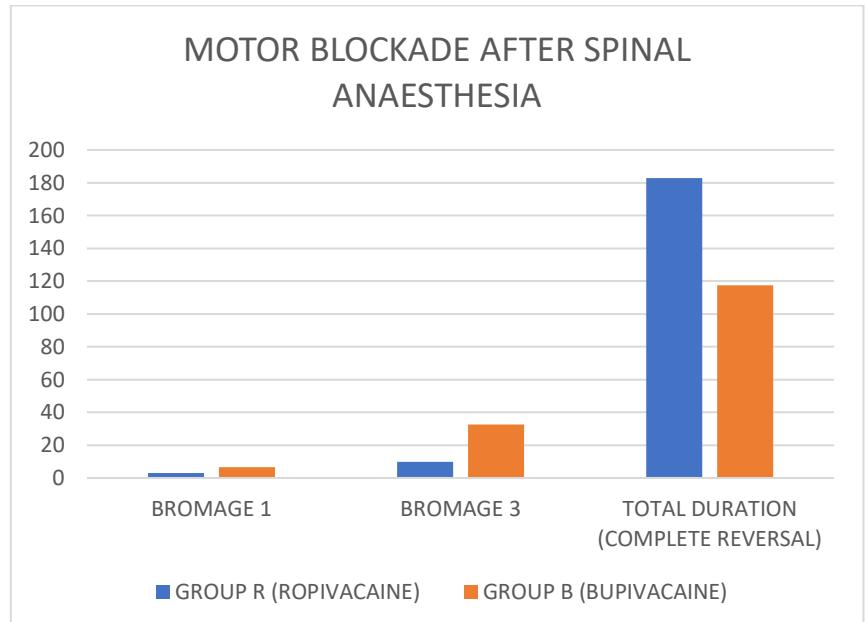
**Comparison of motor block achieved in both groups**

	GROUP R (ROPIVACAINE)	GROUP B (BUPIVACAINE)	P Value
BROMAGE 1	2.87 ± 0.55	6.72 ± 0.98	< 0.0001
BROMAGE 3	9.82 ± 0.67	32.55 ± 3.09	< 0.0001
TOTAL DURATION (COMPLETE REVERSAL)	182.89 ± 9.54	117.45 ± 22.61	< 0.0001

**Comparison of spinal anaesthesia converted to general anaesthesia**

Converted to General Anaesthesia	GROUP R (ROPIVACAINE)	GROUP B (BUPIVACAINE)
Yes	00	128
No	138	10





## DISCUSSION

Scorpion stings are a common occurrence in India. Usually harmless, with manifestations such as severe pain and burning sensation at the site of sting. Systemic manifestations such as myocardial infarction, acute pulmonary oedema, cardiogenic shock and death are very rare. Thus, a large rural population coming for elective surgical procedures, may give history of grades 1 or 2 stings. Scorpion venom is a weak acid (pH 6.5) and a highly complex mixture of salts, nucleotides, biogenic amines, enzymes, mucoproteins and neurotoxins, acting on ion channels specifically voltage gated sodium channels (VGSC). Out of various scorpion toxins, alpha and beta toxins are known to bind to mammalian VGSC. The alpha toxin binds extracellularly to S3-S4 loop in domain IV and extracellular part of segment S5-S6 of domain I. The beta toxin binds to extracellular part of segment 4 of domain II. The binding site of local anesthetics (LA) is segment 6 of domain IV of the alpha subunit of VGSC. [8,9]

Kosam et al. (2015) [6] highlighted that patients with a past history of scorpion sting often experience inadequate spinal block, sometimes requiring conversion to general anaesthesia. They recommended screening for previous stings in regions where scorpion stings are common but did not suggest specific alternative drugs.

Varghese & Dhulkhed (2022) [7] reported that spinal anaesthesia failure in a patient with a history of scorpion sting could be overcome by adding additives like clonidine and sodium bicarbonate to bupivacaine, though they did not experiment with alternative anaesthetic agents.

Panditrao et al. (2012) [8] observed in their case report that bupivacaine failed not only in spinal anaesthesia but also in peripheral nerve blocks. They suggested that testing other anaesthetic agents in peripheral nerve blocks could be beneficial. Panditrao et al. (2013) [9] studied 70 patients with a history of scorpion bites undergoing surgery and found resistance to bupivacaine spinal block, leading to inadequate anaesthesia or complete block failure. They noted that multiple and recent scorpion bites correlated with higher failure rates but did not exclude patients with neurological disorders.

Gokulakrishnan & Umamageshwaran's case report examined spinal anaesthesia failure in a scorpion sting patient, even when bupivacaine was combined with fentanyl [10]. They concluded that no additives should be used in large-scale studies on spinal anaesthesia efficacy.

During routine clinical practice at the institution, repeated occurrences of ineffective or failed spinal anaesthesia were observed in patients with a history of one or multiple scorpion bites. These individuals appeared to show resistance to the bupivacaine spinal block, which led to insufficient anaesthesia or complete failure, requiring a shift to general anaesthesia. The likelihood of spinal block failure was notably higher in patients who had experienced multiple scorpion bites or more recent stings. [9]

Patients with past history of scorpion sting leads to inadequate block or failure of subarachnoid block necessitating conversion to general anaesthesia. Anaesthesiologists should always ask past history of scorpion sting prior to surgery in all patients in regions where scorpion sting is common. [6]

Successful outcome of spinal anaesthesia in a patient with a history of scorpion sting and failed spinal anaesthesia (2022). R John Varghese\*, V Dhulkhed. Krishna institute of medical sciences, Karad, India. This time, patient was administered spinal anaesthesia with a combination of 1.5 ml of 0.5% bupivacaine heavy, 1.5 ml of 5% lignocaine heavy, 15mcg of clonidine (0.1 ml) and 7.5% sodium bicarbonate (0.2 ml) to make a total volume of 3.3 ml. Spinal anaesthesia was successfully established. [7]

In our study, we have compared the bupivacaine versus ropivacaine. As all of these references suggests, we have given bupivacaine spinal anaesthesia to 138 patients with history of scorpion bite, out of them only 10 patients had effect onset with bupivacaine (less than 10%). Among these 10 patients, 1 patient did not achieve Bromage 3 for motor blockade and others get delayed effects. there's significant delay in onset of sensory and motor both.

Saurabh Trivedi et al (2024), concluded from series of 10 cases of recent scorpion bite that Intrathecal hyperbaric ropivacaine may be considered as the local anaesthetic agent of choice in patients with a scorpion sting to prevent failure of sub-arachnoid block. Further scientific studies are needed to further validate these findings.[11]

In our study, we had given ropivacaine to 138 patients with history of scorpion bite either recent or old. All of 138 patients had satisfactory effect both motor and sensory and no one of them required general anaesthesia. We had increased our number to get more reliable results.

## CONCLUSION

Patients with history of scorpion bite posted for below umbilical surgery under spinal anaesthesia may be considered hyperbaric ropivacaine, as it had faster, satisfactory and longer effect and did not need general anaesthesia in comparison to hyperbaric bupivacaine.

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