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Research Article

Scorpion Bite

Effect of Previous Scorpion Bite on the Efficacy of Intrathecally Administered Bupivacaine in Subarachnoid Block

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Aim: To study the efficacy of spinal anesthesia in patients with previous scorpion bites and patients with no such history. **Method:** In this study, 40 patients were divided into two groups each of 20, patients with h/o scorpion bite (group -1), patients with no such history (group -2), scheduled for lower abdominal and lower limb surgeries, the subarachnoid block was given with 3.0 ml of injection Bupivacaine 0.5% heavy using 26 gauzes Quincke spinal needle. A blind observer recorded a sensory block using a needle prick and a motor block using the Bromage scale. **Result:** Patients who had previous scorpion bites (group -1) had a significant failure rate of spinal anesthesia compared to the patient with no such history (group - 2). Our study shows how in the bite group, the onset and peak effect of sensory and motor block is prolonged statistically significantly after exposure to a scorpion bite. It also depends on the number of exposures, as shown in table 4. **Conclusion:** In this study, it was observed that the patients with scorpion bites had a significant failure rate of spinal anesthesia, suggesting probable resistance to the local anesthetic agents as observed in previous similar studies.

Keywords: Scorpion Bite, Subarachnoid Block, Quincke Spinal Needle, Bromage Scale

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Introduction

Regional anaesthesia for the lower limb and lower abdomen surgeries is not only performed for adequate anaesthesia, but also excellent postoperative analgesia, reduced side effects, decreased blood loss, lower incidence of deep vein thrombosis, and shortened stay in post anaesthesia care unit (PACU). Spinal anesthesia failure is an uncommon phenomenon. This may be erroneously attributed to poor technique/ less skill on the part of the anesthesiologist. It might not be the mistake of the anesthesiologist, but some unknown factors might be responsible for resistance/failure of the subarachnoid block. [1-5]. The reported incidence of spinal anesthesia failure is 0.72% - 16%. In India, two types of poisonous species of scorpion are important - small red Buthus tamulus and the large black Palamneus gravimanus. Buthus tamulus is more toxic. Mesobuthus tamulus (the Indian red scorpion) is the most lethal amongst all poisonous species of scorpions in India [7]. In our region, scorpion stings are common. The scorpion venom contains neurotoxins that block the sodium channels (beta-toxins). Delayed activation of sodium neuronal channels by the venom causes a massive release of endogenous catecholamines into the circulation resulting in clinical manifestations and complications of scorpion sting.[7].

Spinal anesthesia is a common anaesthetic technique used for various surgical procedures. Failure of subarachnoid block may occur even in expert hands. Causes of failure of spinal anesthesia may be poor patient positioning, incorrect insertion of spinal needle, spinal abnormalities, obesity, errors in drug injection, inaccurate dose of the drug, misplaced injection, inadequate intrathecal spread, inadequate drug action, local anaesthetic resistance etc. Local anesthetics administered by spinal anesthesia acts via sodium channels. Mutations of sodium channels may be responsible for resistance to local anesthetic agents. Scorpion venom contains neurotoxic proteins. Alpha and Beta toxins affect sodium channels. Scyllatoxin, charybdotoxin and tityus toxin inhibits calcium-dependent potassium channels and also causes the opening of sodium channels at presynaptic nerve terminals. Sodium channels are composed of α and ß subunits. A subunit has four homologous domains (D 1-4), each containing six transmembrane α helices (S1-S6). S4 segment plays a crucial role in channel activation. Scorpion ß toxin bind to receptor site 4 of voltage-gated sodium channels, thereby modifying the activation process of the channel. In view of the high prevalence of scorpion stings in our region and observation of failure of spinal anesthesia in patients with a history of scorpion stings in routine practice, the present study is planned. [8].

Materials And Methods

Study setting and design: This will be a case-control study on all the admitted patients with a previous history of one or more scorpion bites, posted for elective surgery under spinal anesthesia over six months, after obtaining approval from the institutional ethics committee and patient consent in the Department of Anaesthesiology, Government Medical College, Chhindwara (M.P), with the following inclusion and exclusion criteria:

Inclusion criteria:

- Patients of ASA grade 1, 2 and 3.
- Patients between the age group of 18 to 70 years of either sex.
- Patients undergoing elective infraumbilical surgery under spinal anaesthesia.
- Patients with a previous history of one or more scorpion bites.

Exclusion criteria:

- ASA grade 4 and above.
- Known history of allergy or sensitivity to injection Bupivacaine.
- Patients known intracranial space-occupying lesion raised intracranial pressure.
- Patients with pre-existing neurological diseases, peripheral neuropathies.
- Patients with infection at the injection site (risk of meningitis).
- Patients with known coagulation disorders.
- Pregnant or lactating females.

Patient's grouping:

Group 1: Patients with a previous history of one or more scorpion stings comprised the case group.

Group 2: Patients with no history of scorpion sting undergoing surgery under spinal anesthesia comprised the control group.

Pre-anaesthetic assessment of all the selected patients will be done with complete history, general physical and systemic examination, airway assessment, spine examination, along routine investigations, as for any standard infraumbilical surgery.

All patients will be preloaded with 1000 ml of Ringer Lactate solution, placed in lateral position and space between 3rd and 4th lumbar spine will be identified and marked. After taking all aseptic measures, a lumbar puncture with a 25 gauge spinal needle and hyperbaric Bupivacaine 0.5%, 3.5 ml will be administered. Immediately after injection of Bupivacaine patient will be placed in the supine position. Electrocardiography, SpO2, heart rate and non-invasive blood pressure monitoring will be done intraoperatively.

In the operating room, the following parameters will be recorded:
T0-time of the spinal injection
T1-onset of the sensory block
T2-onset of motor block
T3-peak of sensory block
T4-peak of motor block

If, after 20 minutes of the waiting period, the block will not be adequate, general anaesthesia will be administered. At the end of the surgery, all patients will be transferred to Post Anaesthesia Care Unit for postoperative monitoring during the first 24 hours. The sensory block was assessed by pinprick with a 24 gauge hypodermic needle. The onset of the sensory block will be defined as the time when the patient could not feel the pain.

The motor block was assessed with the Bromage scale [15]. as follows-

Grade of motor block	Features
Grade 3	Complete block, unable to move feet or knees.
Grade 2	Almost complete, able to move feet only or plantar flexion of the big toe.
Grade 1	Partial, just able to flex/move knees.
Grade 0	None, full flexion of knees, hip and feet.

The onset of the motor block will be considered when the patient cannot flex the hip. The time of peak sensory and peak motor levels will be considered when the maximum/upper most level of the block will be achieved. There will be no further progression of the sensory or motor blockade above that level. The block will be considered Adequate when the level of sensory/motor block of up to T6-T8 is achieved. If after 20 minutes of waiting period the block will not be adequate, general anaesthesia will be administered.

Statistical Analysis

Data was compiled using MS excel 2007, and analysis was done with the help of Epi-Info 7 software. Frequency and percentage were calculated & a statistical test (Chi-Square) was applied wherever applicable; $p<0.05$ was taken as statistically significant. The observations will be recorded and subjected to statistical analysis using SPSS statistical software. The student's test was used for inter-group comparison. P-values >0.05 and <0.05 were considered statistically insignificant and significant, respectively.

Results

Forty patients of both sexes, aged between 18 to 60 years, were included in the study. The anaesthesiologists administering spinal anaesthesia were comparable in the two groups. The groups were comparable to each other in all respects. [Table 1] Frequency and percentage of scorpion bites in the two groups were also comparable. Twenty-nine patients had a history of single bites, whereas eight patients were bitten twice, three patients thrice, and five patients were bitten four times. [Table 2].

Table 1: Characteristics of Patients in In the Two Groups

Parameters	Group S N 20(%)	Group C N 20 (%)	Total 40	P Value
Age in years (range)				
Less than 24 years	1 (2.9)	2 (8.6)	3 (8.7)	
25-34 years	2 (8.6)	2 (8.6)	4 (20.0)	
35-44 years	2 (8.6)	05 (31.4)	7 (17.1)	
45-54 years	5 (22.9)	3 (11.4)	8 (5.7)	
55-60 years	10 (57.1)	8 (40.0)	18 (48.6)	
Age in years (mean+SD)	50.06+5.81	48.46+6.43	51.96+6.30	0.112
Gender				
Male	12 (62.9)	9 (48.6)	21 (55.7)	0.229
Female	08 (37.1)	11 (51.4)	19 (57.1)	
ASA				
1	02 (17.1)	08 (31.4)	10 (24.3)	0.378
2	9 (62.9)	12 (51.4)	21 (57.1)	
3	5 (20.0)	4 (17.1)	9 (18.6)	

Table 2: Frequency and Percentage of Scorpion Bites in the Two Groups

Number of bites	Number of patients	Percentage
1	13	65
2	3	15
3	1	5
4	3	15
Total	20	100

Table 3 shows the onset and peak of sensory and motor blocks in the two groups. It clearly shows how the bite group onset and peak effect of sensory and motor block is prolonged statistically significantly after exposure to a scorpion bite. It also depends on the no, of exposures as shown in table 4.

Table 3: The Onset of Sensory and Motor Block

Points in time	Group S	Group C	Total	P value (P)
Onset of sensory block (min)	2.31 ± 1.68	1.53 ± 0.64	1.97 ±1.36	4.67 (0.034)
Onset of Motor block (min)	2.91 ± 1.80	1.60 ± 0.63	2.36 ±1.50	10.998 (0.034)
Peak of sensory block (min)	6.45 ± 2.83	3.60 ± 0.84	4.97 ± 2.47	30.48 (0.000)
Peak of Motor block	7.8 ± 3.95	4.56 ± 1.30	6.02 ± 3.31	22.36 (0.000)

Table 4: Relation of No. of Scorpion Bites To Onset of Sensory and Motor Block, Time To Peak Of Sensory And Motor Block

Number of bites	The onset of sensory block	The onset of Motor block	The peak of sensory block	The peak of the motor block
0 (Group C)	1.53 ± 0.64	1.6 ± 0.63	3.60±0.84	4.56±1.3
1 (Group S)	2.48 ± 1.85	3.0±2.02	6.62±3.09	8.2±4.54
2 (Group S)	2.25± 2.06	2.5±1.29	5.67±2.08	6.75±1.71
3 (Group S)	2.1 ± 1.0	3.57±2.41	9.5±0.71	9.0±1.24
4 (Group S)	1.8 ± 0.84	3.4±0.45	5.0±1.41	7.0±3.16
P	0.228	0.019	0.000	0.001

Discussion

Panditrao MM et al. studied that scorpion bites lead to the development of resistance to the effect of local anaesthetics. A patient posted for vaginal hysterectomy was administered Subarachnoid block, which failed, repeated in one space above. The block failed again after waiting for 30 min. The patient gave a history of scorpion bite twice, once at 17 years on her right foot and again about eight months back. After that, balanced general anaesthesia was given. On the eighth postoperative day, after explaining her possible resistance to local anaesthetic agents, the patient was given left median, ulnar and radial nerve blocks at the wrist and local infiltration near the anatomical snuff box. There was neither sensory nor motor block. The conclusion derived was that the scorpion venom affects the pumping mechanism of sodium channels in the nerve fibres, which are involved in the mechanism of action of local anaesthetic drugs. It may be responsible for the development of 'resistance' to the action of local anaesthetic agents. [9].

A case-control study was done by Panditrao MM et al. on the effect of previous scorpion bites on the action of intrathecal Bupivacaine. During the routine practice in the institution, it was observed that there were persistent incidents of inadequate/failed spinal anaesthesia in patients with a history of single or multiple scorpion bite/s. The authors concluded that there appears to be a direct correlation between the histories of old, single or multiple scorpion bites and the development of resistance to the effect of local anaesthetics administered intrathecally.[10]. Similar studies were done by Trescot AM et al. and Mehrotra A et al. on the effect of Scorpion Bite on Subarachnoid Blockade. There are several reasons for the failure of the block, either technical errors or errors due to chemical interactions. There are genetic reasons also like red hair individuals, and a history of single or multiple scorpion bites has recently been reported are resistant to subcutaneous local anesthetics. The antigenic nature of scorpion venom makes it more significant as it may evoke a very potent antigen-antibody response causing failure of the spinal blockade. [11,12].

Panditrao MM et al. studied a case of a repeated scorpion bite, which led to resistance to the effect of local anesthetics. An eighty-year-old, bronchial asthmatic male was posted for left cataract extraction with intraocular lens implantation. He was administered peribulbar block/left facial nerve block. There was no sensory or motor block. After that, the peribulbar block was repeated. Only partial akinesia was achieved, so under intermittent

Intravenous sedation, the surgery continued for 40 minutes. In the postoperative period, no signs of any residual/delayed block were noted. On specific enquiry, the patient gave history of scorpion bite thrice, at the age of 27 years on his right foot, about 8 - 9 years back and again about 6 - 7 months back on his right hand. The cause of the failures may be due to technical inability to achieve block. However, a failure that occurs despite the technically correct injection of the correct drug can be mystifying. As the scorpion venom is known to affect the pumping mechanism of sodium channels in the nerve fibres, which are involved in the mechanism of action of local anaesthetic drugs, it may be responsible for the development of "resistance" to the action of local anaesthetic agents.[13].

To test any possible correlation between scorpion bite and the altered response to spinal anaesthesia, a case-control study was conducted by Issin A et al. involving patients with a history of scorpion bite/s and without such a history. The anaesthetic management was identical inclusive of the subarachnoid block with 3.5 ml. 0.5% bupivacaine heavy. The onsets of sensory, motor and peaks of sensory and motor blocks were observed with the pinprick method and Bromage scale. After waiting for 20 min, if the block was inadequate, then balanced general anaesthesia was administered. We conclude that there appears to be a direct correlation between the histories of old, single or multiple scorpion bites and the development of resistance to the effect of local anaesthetics administered intrathecally.[14]. In 2015 Panditrao MM et al. proposed a hypothesis. They reported a yet unrecognized development of resistance to the effect of local anesthetic agents administered via various routes due to single or multiple previous scorpion bites.[15].

Conclusion

In this study, it was observed that the patients with scorpion bites had a significant failure rate of spinal anesthesia, suggesting probable resistance to the local anesthetic agents as observed in previous similar studies.

What This Study Add To Existing Knowledge

In this study, it was observed that the patients with scorpion bites had a significant failure rate of spinal Anesthesia, suggesting probable resistance to the local anesthetic agents as observed in previous similar studies.

Contribution By Different Authors

First Author: -Dr Ashwini Patel: Data collection and statistical analysis **Second Author & Corresponding Author**:- Dr Sonali Tripathi: Concept And Discussion

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