CASE REPORT

Scorpion Sting: A Reason for Failed Local Anesthetic Action

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Abstract

Failed action of local anesthetics can be due to technical errors, but resistance to local anesthetic agents can also be a reason. Scorpion venom has the potential to cause antibodies to local anesthetics and genetic mutations in the receptors resulting in local anesthesia resistance.

We would like to report two cases with a history of scorpion stings in the past where resistance to local anesthetic agents was seen. Local anesthesia resistance can be manifested as inadequate block or block failure. In such cases, the anesthesiologist should keep a history of scorpion bite in mind in areas where scorpion sting is common. Eliciting the history of scorpion bites should be a part of the routine preoperative protocol in areas where scorpion bites are frequent.

Keywords: Case report, Failed local anesthesia, Local anesthesia resistance, Scorpion sting, Spinal anesthesia failure.

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Introduction

Failure to achieve adequate block by local anesthetics, though uncommon, is a cause of distress to the anesthesiologist and the patient. Failed action of local anesthetic agents is generally attributed to technical errors although resistance to local anesthetic agents can also be a reason.[1,2] Scorpion stings are common in rural parts of India and are known to cause local anesthetic resistance.[2,3] Scorpion venom, being highly antigenic, has the potential to cause antibodies to local anesthetics and genetic mutations in the receptors, resulting in local anesthesia resistance.[3]

We would like to report two cases where both patients had resistance to local anesthetic agents and had a history of scorpion stings in the past.

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Case Description

Case 1

A 55-year-old male patient with American Society of Anesthesiologists (ASA) 1 physical status was posted for plating of a left medial malleolus fracture. In the operation room, standard monitors (electrocardiogram, oxygen saturation, and noninvasive blood pressure) were attached. Following preloading, a subarachnoid block was given with 3 mL of 0.5% hyperbaric bupivacaine after confirming the free flow of cerebrospinal fluid. Despite waiting for about 30 minutes, the patient did not show any sign of sensory or motor block. Hence, general anesthesia was administered and the surgery was performed uneventfully. At the end of the procedure, an ultrasonography-guided popliteal sciatic nerve block with 20 mL of 0.5% bupivacaine and 10 mL of 2% lignocaine adrenaline was given for postoperative analgesia. The patient was then shifted to the recovering room where he complained of severe pain at the operative site. Fentanyl infusion was started at 20 µg/hour which provided adequate pain relief and the patient was subsequently shifted to the ward. Failure of both spinal block and popliteal sciatic block raised suspicion regarding local anesthesia resistance. On specific questioning, the patient gave details of undergoing hydrocele repair under local anesthesia 10 years back uneventfully. But, he gave a history of scorpion bites while working on his farm a year ago. To confirm if local anesthesia resistance might have developed due to the scorpion sting, after obtaining informed consent from the patient, 2 mL of 2% lignocaine was injected into the ventral aspect of his forearm. The patient was able to feel a needle prick sensation indicating local anesthesia resistance.

Case 2

A 70-year-old male patient with ASA 2 physical status was posted for umbilical hernioplasty. The patient had given history of a failed spinal followed by administration of general anesthesia for prostate surgery a year ago. Attributing the previous failed spinal anesthesia to technical reasons, spinal anesthesia was given with 3 mL of 0.5% of hyperbaric bupivacaine after confirming the free flow of cerebrospinal fluid. Despite waiting for about 20 minutes, the patient did not show any sign of sensory or motor block indicating spinal anesthesia failure for the second time. On specific questioning, the patient gave a history of a scorpion bite that occurred 2 years ago. The surgery was performed under general anesthesia uneventfully.

Discussion

Spinal anesthesia failure has been well-documented (1–17%) with some of the known reasons being procedural problems with lumbar puncture, anatomical abnormality, subdural injection, or partial epidural injection of spinal dose, inadequate spread or misdistribution of drug, inadequate dose according to the surgery site, loss of potency of drugs, also resistance to local anesthesia, etc. Besides reasons like Ehlers–Danlos syndrome, atypical receptor site, etc., resistance to local anesthetics is also seen in patients with scorpion bites in the past.[4,5]

In our first case report, the spinal failed to act along with the failure of regional block and subcutaneous injection ruling out technical reasons for failure, while in our second case report, there was a spinal failure on two occasions despite technically sound administration of spinal anesthesia. Both patients gave a history of scorpion stings in the past. Our first patient had undergone a surgical procedure under subarachnoid block uneventfully before the sting ruling out inherent resistance to local anesthetics.

Voltage-gated sodium channels are essential for the generation and propagation of action potential. Local anesthetics act by blocking the sixth segment of domain four of the α subunit on the sodium channel.[6,7] There is a direct correlation between scorpion bites and the development of varying degrees of resistance to local anesthetics.[1,2] Scorpion venom is complex and comprises various proteins which are neurotoxin, cardiotoxin, nephrotoxin, hemolytic toxin, chlorotoxin, enzymes such as phospholipases and hyaluronidases, glycosaminoglycans, histamine, serotonin, tryptophan, and cytokines. Each scorpion variety has its arsenal of components and is known to induce immunological response, persistent neurological symptoms, and genetic mutations.[3] The toxins affect the Na, K, and Ca channels by interfering with the pumping mechanism of these channels. α and β toxins affect the sodium channels. β toxins bind to the receptor site 4 of the sodium channel and modify its activation leading to local anesthetic resistance causing delays or failures of spinal anesthesia.[8] The consequences of these failures are a waste of time and resources besides causing distress to the patient and anesthesiologist.

In a study done by Panditrao et al., it was concluded that more than one bite and more recent bites (<8 months) were associated with complete block failures.[1] Resistance is also seen in patients administered local anesthetics *via* different routes like epidural, brachial plexus block, and peribulbar block.[2] One possible mechanism for local anesthetic resistance could be that the scorpion venom evokes a potent immunological response, especially after multiple events of scorpion bites.[1] Antibodies formed against the venom circulating at the time of administration of local anesthetics cause competitive antagonism with them at the α subunit of the sodium channel. Receptor mutation in the amino acid sequence of the sodium channel (IV S6) results in alteration of the site of action leading to local anesthetic resistance.[6,8] Adding an adjuvant like clonidine or fentanyl to the local anesthetic may reverse this action and help in achieving a successful block.[9] Furthermore, since the site of action of local anesthetics and the scorpion venom is the same, bupivacaine may offer partial protection against the inhibitory effects of the scorpion venom.[10]

Conclusion

Resistance to local anesthetics is difficult to diagnose. It is manifested as inadequate spinal block or block failure. In such cases, the anesthesiologist should keep a history of scorpion bite in mind in areas where scorpion sting is common. Eliciting the history of scorpion bites should be a part of routine preoperative protocol in areas where scorpion bites are frequent which will help in planning the mode of anesthesia. Management of postoperative pain can also be a challenge as regional nerve blocks may not work and the use of opioids, nonsteroidal anti-inflammatory drugs, etc., can be considered.

References

1. Panditrao MM, Panditrao MM, Sunilkumar V, et al. Effect of previous scorpion bite(s) on the action of intrathecal bupivacaine: a case control study. Indian J Anaesth 2013;57(3):236–240. DOI: 10.4103/0019-5049.115593
2. Panditrao MM, Panditrao AM, Panditrao BI. Single or multiple previous scorpion bites can lead to development of resistance to the effect of local anesthetic drugs administered via various routes: reporting a yet unrecognized phenomenon. Anaesthesiologist 2015;1:10–15.
3. Bawaskar HS, Bawaskar PH. Indian red scorpion envenoming. Indian J Pediatr 1998;65(3):383–391. DOI: 10.1007/BF02761131
4. Fettes PD, Jansson JR, Wildsmith JA. Failed spinal anaesthesia: mechanisms, management, and prevention. Br J Anaesth 2009;102(6):739–748. DOI: 10.1093/bja/aep096
5. Kosam D, Nigam R, Murthy M, et al. Effect of previous scorpion sting on the efficacy of spinal anesthesia - a case control study. Int J Med Res Rev 2015;3(8):826–831. DOI: 10.17511/ijmrr.2015.i8.155
6. Ragsdale DS, McPhee JC, Scheuer T, et al. Molecular determinants of state-dependent block of Na^+ channels

by local anesthetics. Science 1994;265(5179):1724–1728. DOI: 10.1126/science.8085162
7. Gokulakrishnan G, Umamageshwaran P. Scorpion sting and spinal anaesthesia-a rare case report. Int J Appl Res 2019;9(11):50–51. DOI: 10.36106/ijar
8. Cestèle S, Catterall WA. Molecular mechanisms of neurotoxin action on voltage-gated sodium channels. Biochimie 2000;82(9–10):883–892. DOI: 10.1016/s0300-9084(00)01174-3
9. John Varghese R, Dhulkhed V. B187 successful outcome of spinal anaesthesia in a patient with a history of scorpion sting and failed spinal anaesthesia. Reg Anesth Pain Med 2022;47(Suppl 1):A174. DOI: 10.1136/rapm-2022-ESRA.262
10. Panditrao MM, Khan MI, Yadav N. Does scorpion bite lead to development of resistance to the effect of local anaesthetics? Indian J Anaesth 2012;56:575–578. DOI: 10.4103/0019-5049.104582