The Open Anesthesia Journal

Content list available at: https://openanesthesiajournal.com

CASE REPORT

Pain Management During Labor and Delivery in a Patient with Possible Local Anesthetic Resistance: A Case Report

Aksana Aliakseyeva[1,*], Dante Villarreal[2] and Natalia Pawlowicz[3]

[1]*Department of Anesthesiology, Vitebsk State Medical University, Vitebsk, Belarus*
[2]*Department of Biology, The University of Texas at Arlington, Texas, USA*
[3]*Department of Anesthesiology and Pain Management, Texas Health Frisco, Texas, USA*

Abstract:

Background:

Local anesthetic resistance is a clinical entity characterized by inadequate analgesia despite technically well-performed procedures. The exact etiology and pathogenesis of this condition are not yet fully understood.

Case Presentation:

A 36-year-old Caucasian female presented to labor and delivery for induction of labor. On admission, the patient reported failure of epidural anesthesia during the previous delivery. An epidural catheter was placed, and analgesia was reported only at high doses of local anesthetic. The patient's maximum pain level during delivery never reached a score of 2 out of 10.

Conclusion:

The most common causes of regional anesthetic failure are technical or placement failure, failure related to the local anesthetic itself, or localized infection. This patient appeared to have a true local anesthetic resistance, which was overcome by doubling the customary concentration of local anesthetic. Atypical responses to local anesthetics observed in the patient may be due to incomplete penetrance mutations in sodium channels since local anesthetics work through blocking nerve conduction by acting on these channels.

Keywords: Case report, Local, Anesthetic resistance, Epidural, Anesthesia, Resistance.

Article History	Received: March 16, 2022	Revised: May 30, 2022	Accepted: June 30, 2022

1. BACKGROUND

The most common cause of block failure is an inability to successfully access the epidural space. This may occur due to incorrect needling techniques, poor patient positioning, anatomical abnormalities, or equipment-related factors [1]. The exact etiology and pathogenesis of true local anesthetic resistance have not yet been fully elucidated.

We report a case of a 36-year-old female who presented for induction of labor.

An epidural catheter was successfully placed on the first attempt. While sensory blockade was achieved, motor blockade was not obtained despite evidence of appropriate dermatomal distribution of sensory blockade. This clinical presentation and past medical history of this patient imply a true resistance to local anesthetics.

2. CASE PRESENTATION

A healthy 36-year-old female presented for induction of labor at Texas Health Frisco Hospital. On admission, the patient reported a failed epidural with her previous vaginal delivery 26 months ago. The last delivery was performed at another institution, and according to the provided records, sufficient analgesia was never reached with a customary dose and concentration of local anesthetic (bupivacaine 0.125% epidural block analgesia combined with fentanyl 100mcg).

The patient's past medical history is notable for insufficient analgesia during dental procedures. Her dentist had tried various types of local anesthetics without success. She does not recall the names of the medications used, except lidocaine and bupivacaine. Her younger sister has had the same

* Address correspondence to this author at the Department of Anesthesiology, Vitebsk State Medical University, Vitebsk, Belarus;
E-mail aliakseyevamd@gmail.com

dental issues since childhood, otherwise, her family history is unremarkable. Knowing that local anesthetic resistance can be linked to scorpion bites [2 - 4], the patient was questioned and reported no history of such bites.

2.1. Treatment Plan

Analgesia through an epidural catheter was recommended for her delivery. We presented the patient with a detailed discussion concerning the risks and benefits of the procedure. The patient agreed that epidural analgesia would be performed; the original treatment plan to achieve proper analgesia was to increase the anesthetic concentration instead of the volume.

The patient was prepared for epidural placing. After sterile skin preparation, a skin dose of 3 mL 1% volume lidocaine was infiltrated. On insertion of a 17-gauge Tuohy needle into the skin, the patient complained of moderate pain. Test dose with 3 ml 1.5% lidocaine and epinephrine 1:200000 was negative.

The patient then received a bolus of 100mcg fentanyl, and 10 mL of 0.5% ropivacaine and noted warmth in her feet and buttocks. Of note, 0.2% Ropivacaine is customarily used for epidural bolus and infusion at our institution. It is recommended to administer a 10-20 ml bolus of ropivacaine 0.2% with intermittent 20-30 mg top-up injections or a continuous epidural infusion of ropivacaine 0.2% (6-10 ml/hr) for labor analgesia [5 - 7]. Anticipating difficulties with adequate analgesia, we utilized a higher (0.5%) Ropivacaine concentration from the start of the case. Thirty minutes later, the patient was given 6 mL 0.5% ropivacaine through a programmed intermittent epidural bolus pump (PIEB). The patient started complaining of excessive numbness in her legs around two hours later. Ice and light touch sensation testing showed diminished temperature and nociception perception at the T10 level, respectively. As a result, PIEB dosage of 0.5% ropivacaine was decreased to 4 mL. Two hours later, the patient's PIEB dosage was increased to 5 mL, and a bolus of 2 mL of 0.5% ropivacaine and 100 mcg fentanyl was given due to increasing pain. In the evening, augmentation of labor with oxytocin was started, and the baby was delivered shortly thereafter with adequate pain control. Post-delivery, the patient received 800 mg of Ibuprofen PO.

2.2. Expected and Atual Outcome

The modified treatment plan of increasing the concentration of local anesthetic from the start, in conjunction with occasional bolus doses of fentanyl, resulted in the desired analgesic effect. The patient's maximum pain level during full dilation never reached a score of 2 out of 10.

3. RESULTS AND DISCUSSION

This particular case is important to the medical world because it accentuates one of the few documented cases of local anesthetic resistance where the patient achieved appropriate analgesia. The approach used to reach proper analgesia was to double the concentration of the local anesthetic, while maintaining the same volume, compared to routine labor and delivery cases [7].

The transmembrane membrane segment S6 of domain IV of the Na+ channel alpha subunit is believed to be the local anesthetic receptor site. Specifically, more contemporary research has found only 2 residues on this S6 segment that greatly affected the affinity to the LA: Phe-1764 and Tyr-1771 [5, 6]. Given this information, a possible explanation could be a mutation in one or both of these residues in this S6 transmembrane segment. Increasing the dosage of the anesthetic would thus have allowed more receptors to come into contact with the anesthetic. We chose to augment the concentration, rather than volume to prevent excessive epidural spread while maximizing receptor saturation. A higher number of receptors would be able to come into contact with the anesthetic, increasing the chance of receptor activation. Thus, the treatment plan targeted the suspected receptor site mutation by attempting to saturate the receptor site and recruit more receptors [8].

CONCLUSION

We presented a patient with possible local anesthetic resistance, a history of multiple failures of local dental anesthetic in the past, and a family history of similar symptoms. We were able to achieve proper labor epidural analgesia in this patient after increasing the routinely received concentration of local anesthetic. Since sufficient analgesia level was achieved, presented local anesthetic resistance may be due to incomplete penetrance or genetic alterations in the sodium channel which were overcome by presumed receptor saturation.

AUTHORS' CONTRIBUTIONS

AA: conceptualization, writing of the original draft, review, and editing. DV: conceptualization, writing of the original draft, review, and editing. NP: conceptualization, writing of the review, and editing.

LIST OF ABBREVIATIONS

PIEB = Programmed Intermittent Epidural Bolus Pump.

LA = Local Anesthetic.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Written informed consent was obtained from the patient for publication of this case report.

STANDARDS OF REPORTING

CARE guidelines and methodology were followed.

AVAILABILITY OF DATA AND MATERIALS

The data used to support the findings of this study are available from the corresponding author on request [A.A], except for the patient's personal health information due to

Health Insurance Portability and accountability regulations.

FUNDING

None.

CONFLICT OF INTERESTS

The authors declare that they have no conflicts of interest.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

[1] Rae JD, Fettes PDW. Mechanisms and Management of Failed Spinal Anesthesia 2021.www.nysora.com/foundations-of-regional-anesthesia/complications/mechanisms-

[2] Murthy V, Venkata Ramana. Local anesthesia failure cases with scorpion bite history in third molar surgery- A challenge ARC J Anesthesiol 2017; 2(2): 7-10.www.arcjournals.org/pdfs/aja/v2-i2/3.pdf

[3] Panditrao M, Panditrao M, Sunilkumar V, Panditrao A. Effect of previous scorpion bite(s) on the action of intrathecal bupivacaine: A case control study. Indian J Anaesth 2013; 57(3): 236-40. [http://dx.doi.org/10.4103/0019-5049.115593] [PMID: 23983280]

[4] Panditrao M, Panditrao M, Khan MI, Yadav N. Does scorpion bite lead to development of resistance to the effect of local anaesthetics? Indian J Anaesth 2012; 56(6): 575-8. [http://dx.doi.org/10.4103/0019-5049.104582] [PMID: 23325946]

[5] Ragsdale DS, McPhee JC, Scheuer T, Catterall WA. Molecular determinants of state-dependent block of Na^+ channels by local anesthetics. Science 1994; 265(5179): 1724-8. [http://dx.doi.org/10.1126/science.8085162] [PMID: 8085162]

[6] Yarov-Yarovoy V, McPhee JC, Idsvoog D, Pate C, Scheuer T, Catterall WA. Role of amino acid residues in transmembrane segments IS6 and IIS6 of the Na^+ channel alpha subunit in voltage-dependent gating and drug block. J Biol Chem 2002; 277(38): 35393-401. [http://dx.doi.org/10.1074/jbc.M206126200] [PMID: 12130650]

[7] Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian J Anaesth 2011; 55(2): 104-10. [http://dx.doi.org/10.4103/0019-5049.79875] [PMID: 21712863]

[8] Skelly MF, Kondash S, Mazer SM, Conter EA, Bosmann HB. Properties of a local anesthetic receptor in rat brain. Life Sci 1986; 38(17): 1607-16. [http://dx.doi.org/10.1016/0024-3205(86)90500-X] [PMID: 3702593]