Scientific Research Publishing

Open Journal of Anesthesiology, 2024, 14, 276-280
https://www.scirp.org/journal/ojanes
ISSN Online: 2164-5558
ISSN Print: 2164-5531

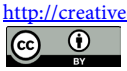
Management of Suspected Local Anesthetic Systemic Toxicity after Caudal Block in an Intubated Pediatric Patient

Dennis E. Feierman*, Mark Kronenfeld, Rajesh Ramnanan#, Evan Salant, Kalpana Tyagaraj

Department of Anesthesiology, Maimonides Medical Center, NY, USA
Email: *dfeierman@maimo.org, MKronenfeld@maimo.org, ESalant@maimo.org, Ktyagaraj@maimo.org, RRamnanan@maimo.org

How to cite this paper: Feierman, D.E., Kronenfeld, M., Ramnanan, R., Salant, E. and Tyagaraj, K. (2024) Management of Suspected Local Anesthetic Systemic Toxicity after Caudal Block in an Intubated Pediatric Patient. *Open Journal of Anesthesiology*, **14**, 276-280.
https://doi.org/10.4236/ojanes.2024.1412024

Received: November 13, 2024
Accepted: December 23, 2024
Published: December 26, 2024



Abstract

We present a case of Local Anesthesia Systemic Toxicity (LAST) in a 7-month-old male after a caudal block placement. The patient was a healthy 8.3 kg male without any medical history, surgical history, significant birth history or any history of family problems with anesthesia. After induction of general anesthesia, a size 1.5 laryngeal mask airway (LMA) was placed, and an intravenous line with 22 gauge catheter was placed. The patient was positioned in the right lateral decubitus position. The caudal space was located by palpation, and a 22 g angiocath was easily placed through the sacral hiatus. Neither blood nor CSF was aspirated through the catheter and 1 ml test dose containing 0.25% Bupivacaine + 1:200,000 epinephrine was administered. After a full minute of watching for any EKG changes, the remaining 8 ml of 0.25% Bupivacaine + 1:200,000 epinephrine was slowly injected into the caudal space with intermittent aspiration. Several minutes after the injection, there was a sudden prominent change in the EKG with QRS complex widening on the EKG accompanied by a drop in $ETCO_2$. 20% Lipid emulsion was administered immediately and a normal EKG pattern returned with a concomitant increase in $ETCO_2$. The planned procedure was performed, and the patient extubated uneventfully. After being monitored in the PACU for an extended period of time, he was discharged home. Follow-up was unremarkable.

Keywords

Pediatric L.A.S.T., Caudal, Local Anesthesia

*Corresponding author.
#Rajesh Ramnanan, MD.

1. Background

Caudal epidural anesthesia is a common neuraxial-regional anesthetic approach in pediatric patients [1] [2]. In the pediatric population, caudal epidural anesthesia is used in addition to general anesthesia: typically, the block would be performed after induction of general anesthesia. The caudal space is the sacral portion of the epidural space which is accessed via needle/catheter penetration of the sacrococcygeal ligament which lies over the sacral hiatus between the S4-S5 laminae. In later adolescence, this area between S4-S5 begins to fuse and during later adulthood, the sacrococcygeal ligament may become calcified, making the caudal approach difficult or impossible. Anatomically, the dural sac extends down to approximately the 3rd sacral vertebra in infants, and eventually migrates cranially, ending at approximately the 1st sacral vertebrae in adults. Due to the more caudal extension in infancy, there is a higher risk of inadvertent intrathecal injection in this population [3]. Applying negative pressure while placing the needle to assess for intravascular placement may present as a false negative as negative pressure may cause the veins to collapse, resulting in no blood being aspirated, while the needle is in fact, intravascularly placed. Therefore, in addition to aspiration, to assess for intrathecal/intravascular placement, we remove the needle, and leave the catheter in place, and examine for fluid (blood/CSF) leakage out of the catheter: a passive flow of CSF or blood.

Local Anesthetic Systemic Toxicity is a life-threatening complication [4] [5] which requires critical clinical skills, to enable early recognition of the signs and symptoms of LAST in order to initiate rapid intervention [6]. Typically, several CNS symptoms present first, preceding severe cardiovascular collapse. Common CNS symptoms include dizziness, confusion, perioral numbness, tinnitus, and seizures.

The early CNS symptoms are absent in intubated, anesthetized patients, thus severe cardiovascular consequences are likely the first signs of LAST especially in a pediatric, anesthetized, intubated patient [7].

The reduced muscle mass of pediatric patients increases the risk of LAST due to the diminished depot effect of the systemically absorbed anesthetic.

Cardiovascular signs can include Peaked T waves and an increased ST segment—these are sensitive indicators of an inadvertent intravascular injection during inhalational anesthesia [8]. Blood pressure increases may also occur, although this is more sensitive during total intravenous anesthesia TIVA [9]. On the more severe end of the cardiovascular spectrum is cardiac arrest.

Intravascular test dosing, specifically with epinephrine, is a reliable method of prevention of LAST. Intravascular test dosing with epinephrine (10 - 15 micrograms/mL) has a sensitivity of 80% in cases where the heart rate increases by 10 beats per minute or more, or the systolic blood pressure rises by 15 mm Hg or more [6]. The order for local anesthetic absorption is based on the vascularity of the anatomical site, which is (in order from highest absorption to lowest): intercostal blocks > caudal > epidural > brachial plexus > sciatic/femoral > subcutane-

ous injection [9].

The effects of intravascular epinephrine injection alone can lead to widened QRS by decreasing the ventricular conduction velocity in healthy myocardium [7].

LAST is a very rare complication of a caudal block. This is a report of a delayed occurrence of LAST after a caudal block, which illustrates the need for continued vigilance and awareness for this complication.

2. Case Report

We present a 7-month-old 8.3 kg male for circumcision and release of chordee who was intubated first, then a pre-procedural caudal block with 0.25% Bupivacaine + 1:200,000 epinephrine was performed. Several minutes later, there was a sudden prominent change in QRS complex on the EKG accompanied by a drop in $ETCO_2$. A lipid emulsion was administered immediately, the EKG patterns normalized and the $ETCO_2$ returned to pre-caudal baseline.

The patient was evaluated in the immediate preoperative period. The was no history of any significant medical problems or family history of problems with anesthesia. This was the patient's first anesthetic exposure. Consent was obtained for both anesthesia and a caudal block for postoperative pain control. After performing a mask induction with 8% sevoflurane, a 1.5-LMA was placed in a supine position and spontaneous ventilation was maintained with 35% O_2 and 4% sevoflurane. A 22 g IV was placed in the right antecubital vein, and the patient received 0.05 mg/kg of morphine and 0.008 mg/kg of glycopyrrolate. The patient was then rotated to the right lateral decubitus position. The caudal space was located by palpation, and a 22 g angiocath was easily placed through the sacral hiatus. Neither blood nor CSF was aspirated through the catheter and 1 ml test dose of 0.25% Bupivacaine + 1:200,000 epinephrine was administered. After a full minute of watching for EKG changes, no changes in heart rate or T waves or the QRS complex were observed. Next, the remainder of 8 ml of 0.25% bupivacaine + 1:200,000 epinephrine was slowly injected into the caudal space. The patient was observed for another minute while cleaning off the chlorohexidine prep solution, and repositioned back into a supine position. Approximately 2 - 3 minutes after repositioning, the patient was prepped for surgery. While the patient was being prepped, well after the injection of the caudal block was completed, there was a sudden prominent change in the EKG. We asked the surgeon to stop prepping as this was interfering with the EKG. It was then established the EKG changes were not an artefact: the EKG showed a widened bizarre QRS complex presenting as ventricular tachycardia. These changes coincided with a drop in End-Tidal CO_2.

Local Anesthestic Systemic Toxicity was suspected, and a lipid emulsion (often referred to as "intralipid") infusion was immediately set up, and with an initial bolus of 1.5 - 2 ml/kg over 1 minute. Normal EKG patterns resumed and the $ETCO_2$ returned to baseline. The planned procedure continued; the patient was successfully extubated. The patient was transferred to the PACU and was moni-

tored with continuous EKG, pulse oximetry and intermittent blood pressure for an extended period of time (>3 hours). The EKG remained normal, with no significant changes in heart rate. Additionally, the blood pressure and oxygen saturation did not vary significantly over time. The patient's behavior was appropriate and was tolerating feeding. The patient was discharged home. Follow-up phone calls were negative for any further anesthesia-related complications.

3. Discussion

Early recognition of the signs and symptoms of Local Anesthetic Systemic Toxicity (LAST) is a very important skill since LAST is life-threatening and early intervention can result in positive outcomes. It is crucial to note that the classic textbook presentation can be masked by General Anesthesia. Typically, in an awake patient, Central Nervous System (CNS) symptoms precede cardiovascular changes, though recognition of CNS effects is often dependent on the patient being awake and spontaneously breathing. General anesthesia and intubation can mask these symptoms, making the diagnosis of LAST challenging and delayed. Furthermore, a severe cardiac event in the setting of LAST can often start as tachyarrhythmia. It is important to rule out any artefacts or transient tachycardia associated with the intravascular injection of epinephrine. Given that the younger pediatric patients have faster baseline heart rates and lower blood pressures, a rapid conversion to a tachyarrhythmia can be missed in this population. Having a high index of suspicion for LAST, along with careful monitoring of the pediatric patient's vital signs and ventilator/respiratory tracings, can lead to prompt and successful treatment with intralipid/lipid emulsion before a catastrophic cardiac event could occur.

The caudal location is one of the more rapidly absorbing sites for local anesthetics. The caudal epidural space is very vascular and may contribute to rapid absorption and rapid increase in the serum levels of local anesthetics. Intravascular injection of the epinephrine could be the reason for initial tachyarrhythmia and changes in the EKG morphology, but these would occur immediately after the injection. In the case being discussed, there was a significant delay in the tachyarrhythmia and changes in the EKG morphology. The changes in EKG coupled with the sudden decrease in $ETCO_2$ help establish the high probability of LAST and prompt response to the use of intralipid/lipid emulsion. The cardiovascular signs and decrease in $ETCO_2$ resolved immediately after the initial bolus of intralipid. The prompt response to intralipid/lipid emulsion confirms this suspicion. In addition to suspecting LAST, another diagnosis high on the differential was rapid absorption of epinephrine, but the cardiocascular changes would not have responded to intralipid injection so dramatically. The physiologically higher heart rate and lower blood pressure in pediatrics can camouflage the manifestations of either LAST or intravascular epinephrine. Additionally, the injection of the anesthetic solution directly into the CSF, could have resulted in a high spinal and apnea. This would have explained the sudden decrease in $ETCO_2$, but it would

not explain the dramatic EKG changes. Vigilant monitoring, especially the EKG morphology, immediately before and for several minutes after and early suspicion of LAST led to the prompt treatment with intralipid/lipid emulsion and averted a catastrophic cardiac arrest.

4. Conclusion

In conclusion, the signs observed were consistent with LAST, and the subsequent resolution of these signs after the use of intralipid leads us to firmly believe that this was LAST. It should be noted, given the potential for cardiac arrest, we feel that it is crucial to immediately administer a lipid emulsion despite not having absolute confirmation of a LAST diagnosis for a favorable outcome.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Coşkun, İ. and Yalçın, O. (2023) Evaluating Caudal Block Enhancements in Pediatric Circumcision: Do Additional Analgesics Make a Difference? *Medical Science Monitor*, **29**, e942557. https://doi.org/10.12659/msm.942557

[2] Osmani, F., Ferrer, F. and Barnett, N.R. (2021) Regional Anesthesia for Ambulatory Pediatric Penoscrotal Procedures. *Journal of Pediatric Urology*, **17**, 836-844. https://doi.org/10.1016/j.jpurol.2021.07.017

[3] Lang, R.S., Hall-Burton, D. and Praslick, A. (2022) Regional Anesthesia, in Smith's Anesthesia for Infants and Children. Elsevier.

[4] Wiegele, M., Marhofer, P. and Lönnqvist, P. (2019) Caudal Epidural Blocks in Paediatric Patients: A Review and Practical Considerations. *British Journal of Anaesthesia*, **122**, 509-517. https://doi.org/10.1016/j.bja.2018.11.030

[5] Sohn, J. (2022) Lipid Emulsion Treatment of Local Anesthetic Systemic Toxicity in Pediatric Patients. *The American Journal of Emergency Medicine*, **57**, 195-196. https://doi.org/10.1016/j.ajem.2021.12.057

[6] McMahon, K., Paster, J. and Baker, K.A. (2022) Local Anesthetic Systemic Toxicity in the Pediatric Patient. *The American Journal of Emergency Medicine*, **54**, 325.e3-325.e6. https://doi.org/10.1016/j.ajem.2021.10.021

[7] Singaravelu Ramesh, A. and Boretsky, K. (2021) Local Anesthetic Systemic Toxicity in Children: A Review of Recent Case Reports and Current Literature. *Regional Anesthesia & Pain Medicine*, **46**, 909-914. https://doi.org/10.1136/rapm-2021-102529

[8] Tanaka, M., Goyagi, T., Kimura, T. and Nishikawa, T. (2000) The Efficacy of Hemodynamic and T Wave Criteria for Detecting Intravascular Injection of Epinephrine Test Doses in Anesthetized Adults: A Dose-Response Study. *Anesthesia & Analgesia*, **91**, 1196-1202. https://doi.org/10.1213/00000539-200011000-00028

[9] Barish, P. (2013) Clinical Anesthesia. Lippincott Williams & Wilkins.