Lidocaine Intravenous Continuous Infusion for Pediatric Pain Management

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Critical Points

1. This procedure applies to patients receiving administration of intravenous low-dose lidocaine infusions for pain management on the pediatric transitional care units, pediatric intensive care units, or pediatric PACU at UCSF Benioff Children’s Hospital San Francisco. This procedure does not apply to patients receiving lidocaine infusions for headache or other non-pain purposes.

2. Contraindications for the use of IV lidocaine include:
   - Concurrent use of regional anesthesia (e.g., Exparel)
   - Hypersensitivity to local anesthetics
   - Stokes-Adams syndrome
   - Wolff-Parkinson-White (WPW) syndrome
   - All forms of heart block
   - Cardiomyopathy, ventricular dysfunction, family history of sudden death
   - Allergy to amide local anesthetics
   - Uncontrolled seizures
   - Significant liver or kidney disease
   - Cardiomyopathy or conduction abnormalities, (e.g., long QT syndrome)
   - Concurrent use of sodium or calcium channel blockers (mexiletine, anticonvulsants such as phenytoin or phosphenytoin). Does not include gabapentinoids

3. Continuous cardiac monitoring is required for all patients

4. Lidocaine infusions may be used as an adjunct in pain management treatments for up to 48 hours

5. Patients Must Meet the Following Criteria:
   - Weight ≥ 40 kg
   - Age ≥ 12 years old
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- Negative pregnancy test
- Ability to verbalize symptoms/side effects

6. Standard dosing:
- Dose range is 18 mcg/kg/min to 33 mcg/kg/min
- Maximum dose is 33 mcg/kg/min
- Titration and range orders are not allowed
- Dose should be based upon IDEAL body weight

7. Monitor at the start of the infusion, and with any increase in dose, heart rate, blood pressure, SpO2, respiratory rate, pain level, sedation score, and side effects: Every 30 minutes x 1 hour, every 2 hours x 4 hours, then every 4 hours until infusion is discontinued

8. Continuous lidocaine infusion orders for analgesia may only be written by an IP3-Integrated Pediatric Pain & Palliative Care Service provider
   - EMERGENCY STOP order may be written by any provider

9. If patient exhibits signs of severe local anesthetic systemic toxicity (LAST), stop infusion and activate code white.

Supplies

- Pharmacy prepared Lidocaine solution
- Portless IV tubing (PMM 62437)
- Alaris IV pump
- LAST treatment rescue kit (verified available- see Appendix A)

Procedure

Administration

1. Verify order was written by a pain or palliative care provider and the order contains all necessary components including:
   - Dose does not exceed 33 mcg/kg/min
   - No dose range or titration orders
   - Parameters indicating when to notify the ordering service (e.g., presence of excessive sedation, decreased respiratory rate and/or decreased oxygen saturation, signs and symptoms of toxicity).
   - LAST treatment included in order panel: intralipid prn order has been placed

2. Administration set up for lidocaine infusion:
   - Assure one dedicated IV access/line for lidocaine infusion (insert additional access for all other medications as needed, e.g., antiemetics)
   - Infuse through tubing without ports
   - Prepare lidocaine bag/tubing and IV pump per medication administration procedure.
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- Program pump in mcg/kg/min; use Alaris guardrails

3. Precautions:
   - Place patient on “Fall Precautions”
   - Hang sign at patient bedside “No Phenytoin or Fosphenytoin”, should not be used to treat seizure

Patient Monitoring

1. Obtain baseline vital signs including heart rate, blood pressure, SpO2, respiratory rate, pain level, sedation level, and BARF score
   a. During infusion, check BARF score as needed

2. Obtain serum lidocaine level as per provider order. Lidocaine level should be obtained 8 hours post initiation of infusion, with dose increase, and with symptoms of LAST toxicity.
   a. Therapeutic: 2.5-5.0 mcg/mL
   b. Potentially toxic: >6mcg/mL (HOLD infusion, evaluate patient, and re-check lidocaine levels in 4 hours; notify providers)
   c. Toxic: >9 mcg/mL (STOP infusion, evaluate patient, and re-check lidocaine levels in 4 hours; notify providers)

3. Monitor at the start of the infusion, and with any increase in dose, heart rate, blood pressure, SpO2, respiratory rate, pain level, sedation score, and side effects:
   a. Every 30 minutes x 1 hour, every 2 hours x 4 hours, then every 4 hours until infusion is discontinued.
      - **Exception for palliative/comfort care patients**: monitoring will be at the discretion of primary service in consultation with the pain or palliative care service

4. Maintain continuous cardiac monitoring and pulse oximetry for the duration of the infusion

5. Monitor for side effects or signs of local anesthetic systemic toxicity (LAST). In pediatric patients, it is common to see severe cardiac symptoms present first before CNS symptoms
   a. **Mild Side Effects**: If these occur, immediately notify provider on TCU team, PICU team, or anesthesiologist in PACU, and notify ordering provider. Monitor patient closely. Discontinuation of infusion may be considered:
      - Perioral numbness
      - Metallic taste
      - Dizziness
      - Tinnitus
      - Restlessness
      - Double vision
      - Hypertension
      - Tachycardia/bradycardia (<40 % from baseline)
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b. **Moderate Side Effects**: If these occur, stop infusion immediately, administer oxygen, and notify provider on TCU team, PICU team, or anesthesiologist in PACU, and notify ordering provider. Activate code white or rapid response and consider providing LAST treatment depending on severity of patient’s condition:
   - Severe dizziness
   - Nausea, vomiting (different from baseline BARF score)
   - Decreased hearing
   - Slurred speech
   - Mild sedation
   - Tremors
   - Mild decrease in blood pressure >30 mmHg or pulse<50 bpm.
   - Visual hallucinations
   - Altered mental status
   - Cardiac arrhythmias (e.g., PVC, PAC)

c. **Severe and Late Signs**: Indicative of local anesthetic systemic toxicity (LAST). If these occur, stop the infusion immediately, administer oxygen and activate code white and initiate treatment for LAST. See [Appendix A](#) for LAST treatment guidelines
   - Twitching
   - Convulsions
   - Loss of consciousness
   - Cardiac arrhythmias (e.g., VT, VF, Asystole)
   - Respiratory arrest
   - Hypotension
   - Bradycardia
   - Tachycardia
   - Cardiovascular collapse

**Emergency Response for Moderate and Severe Side Effects**
- Turn off continuous infusion
- Notify provider on TCU team, PICU team, or anesthesiologist in PACU, and notify ordering provider
- Activate rapid response or code white depending on goals of care and/or severity of patient’s condition

**Documentation and Education**

1. Document on the appropriate flowsheet:
   - Drug name, dose, dose units, rate in mcg/kg/min
   - Total drug amount infused per standard of care
   - Patient-reported adverse effects

2. Provide patient/family education and assess response to teaching. Include:
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- Purpose of medication for analgesia
- Communicate frequently with the patient to query for presence of side effects
- Need to notify RN if pump alarms, pain is uncontrolled, and/or presence of adverse effects

References

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<th>Level*</th>
<th>Reference</th>
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* FAME Scale details: See nursing policy *Policy, Procedure, & Competency Development, Review, & Approval*
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Procedure History

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Reviewed: 

Reviewed / Revised: 2/21 Lena Ngo, RN, MSN; Amber Borucki, MD
Appendix A: Local Anesthetic Systemic Toxicity (L.A.S.T.) Treatment

**American Society of Regional Anesthesia and Pain Medicine**

**Checklist for Treatment of Local Anesthetic Systemic Toxicity (LAST)**

**The Pharmacologic Treatment of LAST is Different from Other Cardiac Arrest Scenarios**
- **Reduce** individual epinephrine boluses to ≤ 1 mcg/kg
- **Avoid** vasopressin, calcium channel blockers, beta blockers, or other local anesthetics

- **Stop injecting local anesthetic**
- **Get help**
  - Consider lipid emulsion therapy at the first sign of a serious LAST event
  - Call for the LAST Rescue Kit
  - Alert the nearest cardiopulmonary bypass team - resuscitation may be prolonged
- **Airway management**
  - Ventilate with 100% oxygen / avoid hyperventilation / advanced airway device if necessary
- **Control seizures**
  - Benzodiazepines preferred
  - **Avoid** large doses of propofol, especially in hemodynamically unstable patients
- **Treat hypotension and bradycardia – If pulseless, start CPR**

<table>
<thead>
<tr>
<th>Lipid Emulsion 20%</th>
<th>Greater than 70 kg patient</th>
<th>Less than 70 kg patient</th>
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</thead>
<tbody>
<tr>
<td>Bolus 100 mL Lipid Emulsion 20% rapidly over 2-3 minutes</td>
<td>Bolus 1.5 mL/kg Lipid Emulsion 20% rapidly over 2-3 minutes</td>
<td></td>
</tr>
<tr>
<td>Lipid emulsion infusion 200-250 mL over 15-20 minutes</td>
<td>Lipid emulsion infusion ~0.25 mL/kg/min (ideal body weight)</td>
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**If patient remains unstable:**
- Re-bolus once or twice at the same dose and double infusion rate; be aware of dosing limit (12mL/kg)
- Total volume of lipid emulsion can approach 1 L in a prolonged resuscitation (e.g., > 30 minutes)

- Continue monitoring
  - At least 4-6 hours after a cardiovascular event
  - Or, at least 2 hours after a limited CNS event
- Do not exceed 12 mL/kg lipid emulsion (particularly important in the small adult or child)
  - Much smaller doses are typically needed for LAST treatment
- See reverse side of this checklist for further details
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Risk Reduction (Be sensible)
- Use the least dose of local anesthetic necessary to achieve the desired extent and duration of block.
- Local anesthetic blood levels are influenced by site of injection and dose. It is important to identify patients at increased risk of LAST prior to using local anesthetics, e.g., infants <6 months old, small patient size, advanced age and frailty, heart failure, ischemic heart disease, conduction abnormalities, or rhythm disorders, metabolic (e.g., mitochondrial) disease, liver disease, low plasma protein concentration, acidosis, and medications that inhibit sodium channels. Patients with very low ejection fraction are more sensitive to LAST and may be especially prone to elevated local anesthetic levels associated with ‘stacked’ injections.
- Consider using a pharmacologic marker and/or test dose, e.g. epinephrine 2.5 to 5 mcg/ml (total 10-15 mcg). Know the expected response, onset, duration, and limitations of a “test dose” in identifying intravascular injection.
- Aspirate the syringe prior to each injection while observing for blood in the syringe or tubing.
- Inject incrementally, while observing for signs and inquiring for symptoms of toxicity between each injection.
- Consider discussing local anesthetic dose as part of the pre-procedural or pre-surgical pause (“time out”).

Detection (Be vigilant)
- Monitor the patient during and after completing injection. Clinical toxicity can be delayed 30 minutes or longer.
- Use standard American Society of Anesthesiologists (ASA) monitors.
- Communicate frequently with the patient to query for symptoms of toxicity.
- Consider LAST in any patient with altered mental status, neurological symptoms or signs of cardiovascular instability after a regional anesthetic (e.g., change in HR, BP, ECG). Consider LAST even when the local anesthetic doses is 1) small (susceptible patient), 2) atypically administered (abruptaneous, mucosal, topical), 3) administered by the surgeon, or 4) after recent tourniquet deflation.
- Central nervous system signs (may be subtle, atypical, or absent)
  - Excitation (agitation, confusion, vocalization, muscle twitching, seizure)
  - Depression (drowsiness, obtundation, coma, or apnea)
  - Non-specific (metallic taste, circumoral numbness, diplopia, tinnitus, dizziness)
- Cardiovascular signs (occasionally the only manifestation of severe LAST)
  - Initially may be hyperdynamic (hypertension, tachycardia, ventricular arrhythmias), then
  - Progressive hypotension
  - Conduction block, bradycardia or asystole
  - Ventricular arrhythmia (ventricular tachycardia, Torsades de Pointes, ventricular fibrillation or asystole)
- Sedation may abolish the patient’s ability to recognize or report LAST-related symptoms.

Treatment

Suggested components of a “LAST Rescue Kit”
- 1 L (total) lipid emulsion 20%
- Several large syringes and needles for administration
- Standard IV tubing
- ASRA LAST Checklist

- Administer lipid emulsion at the first sign of a serious LAST event.
- Lipid emulsion can be used to treat LAST caused by any local anesthetic.
- Standard dose epinephrine (1 mg) can impair resuscitation from LAST and reduce the efficacy of lipid rescue. Use smaller doses than typical for ACLS, e.g., ≤1 mcg/kg boluses, or for treating hypotension.
- Propofol should not be used when there are signs of cardiovascular instability.
- Prolonged monitoring (2-6 hours) is recommended after any signs of LAST, since cardiovascular depression due to local anesthetics can persist or recur after treatment.
  - If LAST event is short-lived and without signs of cardiovascular instability, one may consider proceeding with surgery after an uneventful ~30 minute interval of monitoring.

Please report LAST events to www.lididrescue.org


The ASRA LAST™ smart phone app can be purchased from The Apple App Store or Google Play