Question 1: In pediatric patients is using LMX4 (lidocaine 4%) topical anesthetic cream effective in decreasing pain during intravenous cannulation?

Objective: To critically evaluate the evidence on the effectiveness of using LMX4 in decreasing pain in pediatric patients undergoing intravenous cannulation.

Background: The majority of pediatric patients hospitalized are subjected to intravenous cannulation and repeated venipuncture. Evidence shows that anxiety increases after repeated exposure to needle-sticks when comfort measures are ignored (Kennedy et al., 2008). The management of pain in pediatrics is essential to good medical care.

All patients have the right to comfort. It is unethical to expose pediatric patients to unnecessary pain. The regular use of LMX4 might decrease pain, making the experience of intravenous cannulation less traumatic, and therefore might decrease the fear and anxiety of future cutaneous procedures.

Search strategies included articles published in English, publications within past 10 years, research-based articles, and pediatric patients undergoing intravenous cannulation.

Databases included PubMed and CINAHL.

Key words/terms included LMX4 (or lidocaine 4%, LMX 4, L.M.X.4), injections (or administration, intravenous, needle sticks, IV), pain, anxiety, prevention.

Question 1: In pediatric patients is using LMX4 (lidocaine 4%) topical anesthetic cream effective in decreasing pain during intravenous cannulation?
Grade Criteria: LMX4 (lidocaine 4%) topical anesthetic cream should be used in pediatric patients undergoing intravenous cannulation. Strong Recommendation, Moderate-Quality Evidence.

Four randomized controlled trials were found evaluating the effectiveness of LMX4 (lidocaine 4%) topical analgesic in intravenous cannulation. Three of the studies, one with 142 children, one with 43 adults, and one with 40 adults, used LMX4 versus placebo. All three study results indicated use of LMX4 was associated with decreased procedural pain (Taddio et al., 2005, Cortes Valdovinos, et al., 2009, Herberger, et al., 2012). In addition to less pain, the results of the study involving children indicated using LMX4 resulted in higher intravenous cannulation success rate, less pain, and shorter total procedure time (Taddio et al., 2005).

Lack of additional studies on LMX4 versus placebo was likely due to the ethical controversy of using a placebo on children and the likelihood of increased infliction of pain as a means to evaluate the effectiveness of a topical analgesic.

An additional study of 60 children using LMX4 versus EMLA cream was reviewed. The results of this study indicate both topical analgesics are equally effective, however LMX4 is effective at 30 minutes as opposed to EMLA cream being effective after 60 minutes (Koh, et al., 2004).

Pediatric patients are particularly susceptible to the effects of pain. The more exposure they have to pain, the increased amount of fear and anxiety they have in future procedures and hospitalizations. Topical anesthetics should be used for needle stick procedures whenever possible. Health care practitioners should advocate and intervene to support the best interest of the patient, including comfort and prevention of pain. The American Society for Pain Management Nursing (ASPMN) recommends procedural comfort management before, during, and after painful procedures (Czarnecki, et al., 2011).
<table>
<thead>
<tr>
<th>Author/Date</th>
<th>Purpose of Study</th>
<th>Study Design</th>
<th>Sample Size/Patient Population</th>
<th>Outcomes</th>
<th>Design Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taddio et al., 2005</td>
<td>To determine the success rate of cannulation, analgesic effectiveness, procedure duration and rate of adverse skin reactions when LMX4 is used before intravenous cannulation of children</td>
<td>RCT Double-blinded</td>
<td>142 children aged 1 month to 17 years who required a peripheral intravenous cannula</td>
<td>Relative to children who received placebo, children who received LMX4 had 43% less pain according to the pain scores of the subset of children who self-reported pain and 35% and 43% less pain according to the parent and observer pain scores respectively for all children. The cannulation success rate was significantly higher among children who received LMX4 than among those who received placebo (74% v. 55%; p=0.03). The total procedure time required to achieve successful cannulation was shorter among children who received LMX4 (6.7 minutes v. 8.5 minutes; p=0.04)</td>
<td>Study Limitations = None</td>
</tr>
<tr>
<td>Valdovinos, et al., 2009</td>
<td>To examine the difference in pain scores following topical anesthetic and placebo application</td>
<td>Prospective, blind comparison to a gold standard study</td>
<td>43 adult healthy volunteers</td>
<td>Subjects with the LMX4 experienced statistically significant lower pain scores (t= -3.17, P=.003, 95% confidence interval)</td>
<td>Study Limitations = None</td>
</tr>
</tbody>
</table>
Koh, et al., 2004  
To compare LMX4 at 30 minutes with EMLA at 60 minutes for providing topical anesthesia for IV insertion in children

RCT  
Double blind comparison study  
60 children aged 8 years to 17 years  
No clinically or statistically significant difference in pain ratings (p=0.87) between LMX4 (mean =25.7) and EMLA (mean=26.8) groups.

Study Limitations =  
- None  
- Insufficient sample size  
- Lack of blinding  
- Stopped early for benefit  
- Lack of allocation concealment  
- Selective reporting of measures  
- Large losses to F/U

Herberger, et al., 2012  
To evaluate the analgesic efficacy of LMX4 vs. EMLA vs. placebo. To assess the safety and tolerability.

RCT  
Double-blinded  
40 healthy volunteers  
LMX4 showed significantly reduced pain vs. placebo at all assessment points. Pain reduction was earlier occlusively. No adverse events (p=0.05). No significant difference in LMX4 vs. EMLA.

Study Limitations =  
- None  
- Insufficient sample size  
- Lack of blinding  
- Stopped early for benefit  
- Lack of allocation concealment  
- Selective reporting of measures  
- Large losses to F/U

**APPLY THE EVIDENCE**

LMX4 (lidocaine 4%) Topical Anesthetic Cream should be applied 30 minutes prior to starting an IV in pediatric patients to decrease pain and anxiety.

- Safe and approved for all patients > 37 weeks age of gestation
- Works by preventing the initiation and transmission of nerve impulses and provides cutaneous analgesia by acting on free nerve endings in the dermis
- Works best when it mixes with the natural oils so it is best not to clean the site prior to applying
- Apply gloves and rub a small amount of LMX4 onto each of the sites (can apply to multiple sites) for about 30 seconds. Follow the application with a thicker coating. Cover the sites with an occlusive dressing such as tegaderm.
- LMX4 works best after 30 minutes. Do not leave on skin for > 2 hours. Remove product; clean and prepare skin as usual for the IV procedure.


