Improving pain management for pediatric patients undergoing nonurgent painful procedures

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Problem

Pediatric patients who undergo painful procedures often do so without the use of analgesics or psychological coping methods. Although topical analgesics and nonpharmacologic interventions have been shown to safely decrease procedure-related pain in children, they remain underutilized.1-4 Inadequate interventions to minimize pain for initial procedures result in a stronger pain response with subsequent painful procedures, even when adequate analgesia is administered.2,5,6 Implementation of evidence-based multidisciplinary protocols to reduce discomfort associated with procedures in pediatric patients has been shown to be safe and effective. A multidisciplinary approach that provides effective education, alternative therapies, training, and policy development is of paramount importance to the success of such endeavors.7

Purpose. The development of a topical analgesia protocol to improve pain management for pediatric patients undergoing nonurgent painful procedures is described.

Summary. Leadership from the departments of pediatrics, neonatology, obstetrics and gynecology, nursing, pharmacy, child life, and phlebotomy were chosen to develop and implement a new protocol for topical analgesia use for nonurgent painful procedures in pediatric patients. A review of the published literature on pain management in neonates, infants, children, and adolescents led to the replacement of lidocaine 2.5%–prilocaine 2.5% with liposomal lidocaine 4% topical cream on the formulary. In addition to topical analgesia, psychological and physical methods that enable children to cope successfully with anxiety-provoking and painful experiences were included as part of the education portion of implementation. Child life staff educated other staff, patients, and their parents on pain management techniques, including deep breathing, imagery, and the use of distraction tools. The protocol was transcribed onto preprinted prescriber order forms, which were made available to all pediatric inpatient units, the pediatric emergency department, and the pediatric ambulatory care clinic. A separate form was developed for neonatology. Data from before and after protocol implementation were collected and assessed. Only pediatric patients admitted to inpatient units or seen in ambulatory care clinics were included in the evaluation. The percentage of patients undergoing nonurgent painful procedures treated with topical analgesia or dorsal penile block for circumcisions rose from 2% (preimplementation of protocol) to 92% (postimplementation) (p < 0.0001, chi-square).

Conclusion. A multidisciplinary approach to protocol development and implementation significantly increased compliance to a topical analgesia protocol for pediatric patients undergoing nonurgent painful procedures in a community medical center.

Index terms: Anesthetics, local; Compliance; Lidocaine; Liposomes; Pain; Pediatrics; Prilocaine; Protocols; Topical preparations

Problem

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Background

Current guidelines issued by the American Academy of Pediatrics (AAP) and American College of Obstetrics and Gynecology (ACOG) regarding the management of acute pain1 and pain associated with circumcision3,9 recommend that adequate analgesia be provided for nonurgent painful procedures. At
our 439-bed university-affiliated community medical center, pain management for pediatric patients undergoing nonurgent procedures (e.g., circumcision, intravenous cannulation, venipuncture, arterial puncture, lumbar puncture) was less than optimal. A retrospective chart review of nonurgent procedures performed revealed that less than a quarter of newborns were given topical analgesic cream or dorsal penile block for circumcisions and that no topical pain management was offered to pediatric patients who underwent nonurgent painful procedures. These findings were reinforced by pharmacy purchase records detailing a lack of orders for topical analgesics used in the pediatric population.

Analysis and resolution
Identification of goals. A multidisciplinary team was organized to develop and implement a strategy to improve pediatric pain management. Leadership from the departments of pediatrics, neonatology, obstetrics and gynecology (OB/GYN), nursing, pharmacy, child life, and phlebotomy were chosen, based on their affiliation with the pediatric department, to develop and implement a new protocol for topical analgesia use for nonurgent painful procedures. The primary goal set by the team was to advance the quality of pediatric pain management by (1) increasing the use of topical analgesics for pediatric patients undergoing nonurgent painful procedures and (2) encouraging the use of topical analgesics or dorsal penile block for circumcisions. An additional goal set by the team was to educate patients and health care professionals about nonpharmacologic methods of pain management, such as behavioral distraction, diversionary therapies, kinesthetic methods, imagery, and meditation.

The team recognized that gaining consensus and local leadership support for the analgesia regimen would be challenging but necessary to implement the program. Pediatricians, neonologists, and other prescribers would be pivotal in selecting pain management, with the pediatric house staff and nursing staff enforcing these regimens. OB/GYN staff would be responsible for encouraging the use of pain management for circumcisions. Pharmacy staff would be responsible for developing and implementing preprinted prescriber order forms to educate physicians and nurses about the topical analgesics, in addition to making the forms readily available for use. Child life staff would focus on educating health care professionals and patients on nonpharmacologic pain management techniques. Phlebotomy staff would ensure that a topical analgesic was applied before performing a nonurgent painful procedure on a child.

Development of strategies. Members of the multidisciplinary team met frequently to develop institution-specific topical analgesic guidelines. The departments of pediatrics, neonatology, OB/GYN, nursing, and pharmacy reviewed current published literature on pain management in neonates, infants, children, and adolescents. From this review, and in conjunction with published recommendations by AAP and ACOG for pediatric pain management, the team established guidelines for the use of topical analgesia for the management of pediatric pain during nonurgent procedures. Based on the literature reviewed, liposomal lidocaine 4% cream replaced lidocaine 2.5%–prilocaine 2.5% cream on the formulary. Liposomal lidocaine 4% topical cream has a quicker onset of analgesia (20–30 minutes) compared with that of lidocaine 2.5%–prilocaine 2.5% cream (60 minutes). The longer onset of action of lidocaine 2.5%–prilocaine 2.5% cream was identified as one of the major reasons for nonadherence to the previous topical analgesia protocol. One hour was felt to be too long of a wait to anesthetize a child before a nonurgent procedure. In addition, liposomal lidocaine 4% topical cream causes less skin blanching and vasoconstriction\(^1\) and can consequently increase rates of successful cannulation on the first attempt.\(^1\) Multiple trials have demonstrated the analgesic effects of liposomal lidocaine 4% for venipuncture in pediatric patients. Rapid onset of action allows for a shorter application time without the requirement of an occlusive dressing.\(^1\)\(^2\)\(^4\) In addition, liposomal lidocaine 4% does not contain prilocaine, whose metabolite oxidizes hemoglobin to methemoglobin, which can cause methemoglobinemia,\(^4\) a potential rare adverse effect of lidocaine 2.5%–prilocaine 2.5%.\(^5\)

The topical analgesia (anesthesia) protocol was transcribed onto preprinted prescriber order forms, which were made available to all pediatric inpatient units, the pediatric emergency department, and the pediatric ambulatory care clinic (Figure 1). A separate order form was developed for neonatology. Application of liposomal lidocaine 4% cream was recommended 20 minutes before a nonurgent painful procedure. For circumcisions, lidocaine 4% cream or dorsal penile nerve block was recommended.\(^1\)\(^2\)\(^4\) Adjunctive therapy for circumcisions included a 24% sucrose and water solution via a pacifier during circumcision,\(^1\)\(^7\)\(^8\) followed by a dose of oral acetaminophen 10 mg/kg immediately after the procedure and then as needed for pain for 24 hours postprocedure.\(^1\) The pharmacy department provided all inpatient pediatric units and the ambulatory care clinic with a local supply of the recommended analgesics in automated dispensing devices, improving drug accessibility and decreasing the time to drug administration.

Implementation of strategies. The guidelines were publicized throughout the department of pediatrics, neonatology, and OB/GYN.
**Figure 1.** Preprinted order form for topical anesthesia in children undergoing painful procedures. LMX-4 = liposomal lidocaine 4%.

**Pediatric Order Form for Topical Anesthesia**

**Patient Age:** ______ months/years (circle one)  
**Patient Weight:** ____ kg

**Inclusions:** Patients who are anticipated to need non-urgent intravenous cannulation, venipuncture, arterial puncture or lumbar puncture.

**Exclusions:** Patients with allergies to lidocaine, known hypersensitivity to local anesthetics, open wounds, or use around the eye or in the ear.

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**Medication Order**

LMX-4® Cream topically to site(s) 20-30 minutes prior to the following procedures:

- Intravenous cannulation
- Arterial puncture
- Venipuncture
- Lumbar puncture

Repeat dose with each procedure, up to a maximum of three times a day, spaced by at least two hours.

- Dose for age less than 1 year OR weight less than 10 kg = 1 gram per site.
- Dose for age 1-6 years AND weight of 10-20 kg = 2 gram per site.
- Dose for age more than 7 years AND weight greater than 20 kg = 2.5 gram per site.

**Patient or parent/ legal guardian may refuse treatment at any time.**

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**Directions for Administration:**

- Do not clean skin prior to application of LMX-4®. The medication must mix with skin surface oils to work.
- Apply LMX-4® to the phlebotomy or venipuncture site. Select two sites to anesthetize prior to procedure.
- Rub a pea-sized amount of LMX-4® into the selected site for 30 seconds. Then apply a thick coating with the remaining cream.
- Apply a Tegaderm™ Dressing to the site. The use of the occlusive bandage is recommended to prevent accidental ingestion.
- Do not flatten the LMX-4® underneath the Tegaderm™ Dressing. LMX-4® works best when applied thickly. The site should be anesthetized after 20-30 minutes.
- Remove the Tegaderm™ Dressing, then remove the cream using gauze.
- Prepare the site for the procedure as per usual routine.
- The procedure must be performed within one hour. The effect of LMX-4® will last for approximately one hour.
- For children more than one year of age and 10 kg or greater, do not leave LMX-4® on for more than two hours.
- For children less than one year of age or less than 10 kg, do not leave LMX-4® on for more than one hour.

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☐ I have reconciled these medications with the patient’s current medications administration record on transfer or change of service

**Completed orders must be scanned or faxed to the Pharmacy**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time AM PM</th>
<th>Prescriber’s signature and name printed</th>
<th>Beeper #</th>
<th>Countersignature (if required)</th>
</tr>
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<tr>
<th>Date</th>
<th>Time AM PM</th>
<th>Transcriber’s signature and name printed</th>
<th>RN’s countersign (if required)</th>
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via grand round lectures and direct mailings to prescribers from department chairs. The nursing staff received inservice education about the indications and contraindications for topical analgesia, as did the departments of pharmacy, child life, and phlebotomy. Any suspected adverse event was reported in accordance with current policies and procedures. The preprinted prescriber order forms were completed for all admissions, regardless of whether a nonurgent painful procedure was anticipated during the hospital stay. Parents, guardians, and patients had the right to refuse pain management at any time. This was done to address situations in which adolescents may refuse topical analgesia to “just get it over with.” Further, parents and guardians may refuse pain management because they believe the application of the topical analgesia would make the child overly anxious about the procedure (i.e., blood sampling) that the child knew would follow application of the cream.

The evidence-based multidisciplinary protocol utilizing topical analgesics (or dorsal penile block for circumcisions) was implemented in March 2006 in pediatric patients to safely reduce pain associated with nonurgent painful procedures, including circumcision, intravenous cannulation, venipuncture, arterial puncture, and lumbar puncture. The protocol replaced a similar protocol for topical analgesia utilizing lidocaine 2.5%–prilocaine 2.5% cream that was severely underutilized. In addition to topical analgesia, psychological and physical methods that enable children to cope successfully with anxiety-provoking and painful experiences, including behavioral distraction (i.e., bubbles and pop-up books), kinesthetic methods (i.e., rocking and patting the child), and imagery, were included as part of the education portion of implementation. Child life staff educated other staff, patients, and their parents on pain management techniques, including deep breathing, imagery, and the use of distraction tools.

Protocol evaluation. Data from before and after protocol implementation were collected and assessed. Only pediatric patients admitted to inpatient units or seen in ambulatory care clinics were included in the evaluation. Patients cared for in the emergency department were not included in the analysis due to lack of data. Patients were excluded if they weighed less than 2 kg at the time of the procedure, had a known allergy to lidocaine or its derivatives, or had an open wound or if the procedure site was near the eye or in the ear. Pediatric patients who underwent nonurgent painful procedures were identified through retrospective and prospective chart review. The nurse managers of the units included in the evaluation thoroughly reviewed patients’ medication administration records to evaluate adherence to the topical analgesia protocol (or dorsal penile block for circumcisions). Data were collected retrospectively from December 2005 to February 2006 in the pediatricians and pediatric intensive care units and the pediatric ambulatory care clinics and from January 2005 to February 2006 in the neonatology department (phase 1).

After implementation of the protocol in March 2006, data were prospectively collected from May to July 2006 (phase 2) from the same units. The percentage of patients undergoing nonurgent painful procedures treated with topical analgesia or dorsal penile block for circumcisions rose from 2% in phase 1 to 92% in phase 2 (Table 1). These changes were highly significant ($p < 0.0001$, chi-square), indicative of excellent compliance to the protocol established by the multidisciplinary team. As oral sucrose and acetaminophen were incorporated into the preprinted order form for pain management during circumcision, all patients who received pain management received these adjunct therapies. Few parents, guardians, and patients refused pain management.

Noncompliance to the analgesia protocol mainly occurred during circumcisions. Compliance was not optimal during the initial stages of protocol implementation, often due to a timing issue, where a physician would arrive to circumcise an infant but was unable to wait for analgesia to be administered. However, after one-on-one reeducation of noncompliant physicians by respected opinion leaders within their department about the value of the protocol and

### Table 1.
**Comparison of Adherence to Analgesia Protocol in Phase 1 and Phase 2 of Implementation**

<table>
<thead>
<tr>
<th>Patient Care Unit</th>
<th>Procedure</th>
<th>No. (%) Pts for Whom Protocol Was Used</th>
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<tr>
<td></td>
<td></td>
<td>Phase 1</td>
</tr>
<tr>
<td>Ambulatory clinic</td>
<td>Venipuncture</td>
<td>0/120</td>
</tr>
<tr>
<td>Pediatrics, pediatric ICU*</td>
<td>Intravenous cannulation, venipuncture, arterial puncture, lumbar puncture</td>
<td>0/657</td>
</tr>
<tr>
<td>Neonatal ICU, nursery</td>
<td>Circumcision</td>
<td>20/96 (21)*</td>
</tr>
</tbody>
</table>

*ICU = intensive care unit.

*Of patients who received analgesia, approximately 15% received dorsal penile block and 5% received lidocaine 2.5%–prilocaine 2.5% cream; type of analgesia administered not documented for remaining 80% of patients.

*Of patients who received analgesia, 7% received dorsal penile block and 93% received liposomal lidocaine 4% topical cream.
strategizing by the nursing staff to coordinate analgesia with arrival of the physician, complete compliance was obtained.

During protocol evaluation, two adverse events were reported. The first involved an infant from the pediatric outpatient clinic who licked the lidocaine 4% cream off the site of application, with no adverse effects noted. The second involved a newborn who developed swelling of the glans of the penis shortly after application of liposomal lidocaine 4% cream, an adverse event not expected with the medication. The cream was removed, the swelling resolved spontaneously within a few hours, and the circumcision was canceled.

Discussion

Strategies for improving pain management for pediatric patients undergoing elective painful procedures have focused on avoiding unnecessary anxiety and decreasing pain.2,3 These strategies include pain reduction techniques such as preparing the child and parent, inviting the parent or guardian to be present for the procedure, and maintaining a calm and positive atmosphere.4,5 These interventions are often synergistic with analgesics and have long-term benefits for the pediatric patient. Within months of implementing our protocol, techniques to reduce pain and anxiety, in addition to anesthesia, were used with almost all of these patients. A number of published studies have described improvements in care with the implementation of protocols and treatment guidelines that increase appropriateness of medication use.6,7

Certain factors were crucial to our program’s success. The active and highly visible role of key members from the pediatrics and OB/GYN departments was pivotal to the protocol’s success. Division directors functioned as respected opinion leaders and served as role models to junior house officers. Child life specialists provided a unique resource to the health care team in preparing children and their parents for potentially painful experiences. The program educated prescribers and nursing staff about the care of pediatric pain and encouraged treatment for all patients undergoing potentially painful elective procedures.

Conclusion

A multidisciplinary approach to protocol development and implementation significantly increased compliance to a topical analgesia protocol for pediatric patients undergoing nonurgent painful procedures in a community medical center.

References

15. EMLA (lidocaine 2.5%–prilocaine 2.5%) package insert. Wilmington, DE: Astra-Zeneca; 2005.