

Review Article

Topical analgesics in pediatric dermatology: A review of efficacy and safety

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Abstract

Pain management is an essential aspect of pediatric dermatology, especially for children with skin disorders requiring surgical interventions. This narrative review examines the application of topical analgesics for pain management in pediatric patients, emphasizing their efficacy, safety, and practical guidelines for utilization. By synthesizing outcomes from multiple investigations, we intend to provide healthcare practitioners with an extensive comprehension of how these treatments may improve pediatric dermatological therapy.

Introduction

Pain management is an essential aspect of pediatric dermatology, as young patients (aged 0-18 years) encounter diverse skin problems necessitating therapies. Efficient pain management increases patient adherence to therapies and markedly improves quality of life [1]. Pediatric patients have distinct issues in pain management owing to variations in skin physiology, pain perception, and psychosocial factors [2-6]. The disparities require unique strategies designed for the pediatric demographic, since pain in children can induce worry and distress, hence complicating procedures [7,8].

Topical analgesics provide localized pain relief with fewer systemic effects, rendering them especially beneficial for young patients [9]. Unlike systemic analgesics, topical therapies decrease the danger of systemic toxicity and undesirable effects. This is especially significant in pediatric patients, who may exhibit heightened sensitivity to drugs due to underdeveloped organ systems [9]. Moreover, the non-invasive characteristics of topical analgesics enhance adherence in youth, who may have apprehensions regarding needles or oral drugs [7,10,11].

Commonly utilized topical analgesics in pediatric dermatology include lidocaine, prilocaine (often combined as EMLA cream), capsaicin, and tetracaine. Lidocaine and prilocaine are local anesthetics that inhibit nerve signals, providing swift and efficient analgesia for procedures including venipuncture, biopsies, and laser treatments [12]. Capsaicin, extracted from chili peppers, functions by desensitizing sensory receptors and is utilized for prolonged pain control, especially in chronic pain situations like post-herpetic neuralgia [13,14]. Tetracaine, marketed as Ametop gel, is an alternative utilized for operations such as venipuncture and minor surgeries [14,15].

Objective

This review seeks to encapsulate the efficacy, safety, and therapeutic applications of topical analgesics in pediatric dermatology for minor operations, offering a thorough examination of their advantages and possible hazards.

Methods

A search strategy was employed utilizing databases such as PubMed, Medline, and Google Scholar to gather relevant studies, reviews, and case reports published up to 2023. The search

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terms included “tetracaine,” “topical analgesics,” “pediatric dermatology,” “pain management,” “lidocaine,” “prilocaine,” and “capsaicin.” Boolean operators (AND, OR) were used to refine the search and ensure comprehensive coverage. Additional manual searches of reference lists from key articles were performed to identify any studies that might have been missed.

Selection criteria: The review encompasses literature discussing the use of topical analgesics in children with dermatological conditions. Studies were included if they met the following criteria:

- **Population:** Pediatric patients (aged 0-18 years) with dermatological conditions.
- **Intervention:** Use of topical analgesics, including but not limited to lidocaine, prilocaine, and capsaicin.
- **Outcomes:** Efficacy in pain management, safety profiles, and clinical applications.
- **Study types:** Both clinical trials (randomized controlled trials, non-randomized trials) and observational studies (cohort studies, case-control studies, cross-sectional studies) were considered, along with relevant reviews and case reports.

Studies were excluded if they did not specifically focus on pediatric patients, did not evaluate topical analgesics, or lacked relevant outcomes regarding efficacy, safety, or clinical application. Articles not available in English were also excluded.

Data extraction and synthesis: Data from the selected studies were extracted using a standardized form. Extracted data included study characteristics (author, year, study design, sample size), patient demographics (age, sex, condition), details of the intervention (type of topical analgesic, dosage, duration), outcomes (efficacy measures, safety profiles, adverse events), and key findings. The data were synthesized narratively, focusing on summarizing the evidence for the efficacy and safety of topical analgesics in pediatric dermatology.

PRISMA table

Phase	Number of Records	Description
Identification	50	A total of 50 articles were identified through database searches using the search terms and criteria.
Screening	40	After removing 10 duplicates, 40 articles were screened based on titles and abstracts to determine their relevance to the inclusion and exclusion criteria.
Eligibility	25	25 articles were subjected to full-text review to assess their eligibility based on relevance to pediatric dermatology and topical analgesics.
Included	24	After full-text review, 23 studies met the inclusion criteria and were included in the systematic review. These studies focus on the efficacy and safety of topical analgesics in pediatric dermatology.

Summary of topical analgesics

The primary topical analgesics addressed in pediatric dermatology encompass lidocaine, prilocaine (formulated as EMLA), capsaicin, and tetracaine. Each analgesic is designated for clinical uses according to its characteristics and patient requirements.

Lidocaine is a commonly utilized amide local anesthetic available in multiple formulations, including creams, gels, sprays, and patches. It is preferred for its swift onset of action and efficacy in alleviating pain during minor procedures. Lidocaine is frequently utilized for venipuncture, laser procedures, and laceration repair in pediatric patients. Research has demonstrated its effectiveness in alleviating procedural discomfort [14,16,17]. More specifically to the field of dermatology, Eichenfield and Cunningham (1999) [18] endorsed its application, indicating positive results in pediatric laser interventions. The safety profile is thoroughly characterized, with localized erythema and irritation as the predominant adverse effects [1,16].

Prilocaine, when mixed with lidocaine in EMLA cream, is notably effective for prolonged analgesia. EMLA is extensively utilized for operations including skin biopsies and small surgical interventions. Zaki et al. (2022) [19] showed that EMLA cream markedly alleviated pain in pediatric patients having skin biopsy, whilst Priestley et al. (2003) [15] indicated elevated patient satisfaction with its application in minor surgical procedures. EMLA exhibits a favorable safety profile with few adverse effects, albeit infrequent instances of methemoglobinemia have been documented, especially in neonates and infants [20-22].

Capsaicin, extracted from chili peppers, desensitizes sensory receptors and is predominantly utilized for the therapy of chronic pain, including post-herpetic neuralgia. While infrequently utilized in pediatric dermatology, capsaicin has demonstrated effectiveness in alleviating chronic pain in older children [13]. Nonetheless, the initial stinging sensation upon application may hinder usage. Research indicates that discomfort decreases with successive treatments, rendering it a feasible choice for older children who can endure this initial irritation [13].

Tetracaine, marketed as Ametop gel, is a topical painkiller utilized for venipuncture and small medical operations. Tetracaine offers efficient localized analgesia and possesses a commendable safety profile, exhibiting few adverse effects such as regional erythema and redness [11,21,23]. Tetracaine’s fast onset of action, occurring within 30-45 minutes, renders it an appropriate option for prompt analgesia in young patients.

Efficacy

Lidocaine: has been thoroughly investigated for its effectiveness in alleviating pain during venipuncture, laser procedures, and laceration suturing. Research conducted by Harman et al. (2013) [14] and Sobanko et al. (2012) [17] showed substantial alleviation of pain in pediatric patients undergoing these treatments. Eichenfield and Cunningham (1999) [18] affirmed lidocaine’s efficacy in many pediatric dermatological procedures, noting its rapid onset and low incidence of adverse effects.

Prilocaine (EMLA): The combination of lidocaine and prilocaine in EMLA cream has demonstrated significant efficacy in alleviating pain during dermatological interventions, including

skin biopsies and small surgical operations [15,19]. Its extended duration of action renders it an optimal selection for treatments requiring prolonged analgesia. Numerous studies validate its safety and efficacy; yet, methemoglobinemia persists as a rare but significant concern, particularly in neonates and infants [20].

Capsaicin: Capsaicin has been effective in managing chronic pain disorders in pediatric patients, especially in instances of post-herpetic neuralgia. Research conducted by Rumsfield and West (1991) [13] indicated that while capsaicin initially induces discomfort, frequent application markedly alleviates chronic pain symptoms. Its application in pediatric dermatology is relatively restricted due to the initial burning sensation; nonetheless, it is a viable choice for older children suffering from persistent pain issues [24].

Tetracaine (Ametop gel): Tetracaine has demonstrated efficacy in delivering analgesia for venipuncture and other minor procedures. Research conducted by Taddio et al. (1997) [23] and Kouba et al. (2016) [21] validated its effectiveness, exhibiting minimal adverse effects. The gel's user-friendly administration and swift onset render it an appropriate choice for pediatric pain treatment, particularly in brief operations.

Safety

The safety characteristics of lidocaine and prilocaine are thoroughly established. Lidocaine is linked to negligible side effects, chiefly localized erythema and irritation [1]. Prilocaine, when combined with lidocaine in EMLA cream, exhibits a comparable safety profile but presents a rare risk of methemoglobinemia, particularly in neonates and infants [20]. Appropriate dosing and supervision can alleviate these risks.

Capsaicin is associated with an initial burning and stinging sensation upon application, potentially limiting its usage in young patients [13]. Research indicates that this discomfort lessens with repeated use, making it a feasible choice for older children suffering from chronic pain disorders [24].

Tetracaine exhibits a favorable safety profile, with most side effects confined to localized dermal reactions, including erythema and redness. Systemic toxicity is infrequent but requires monitoring, especially in younger children [21,23].

Clinical recommendations

In light of the evaluated evidence, the subsequent recommendations are proposed for the application of topical analgesics in pediatric patients:

- **Lidocaine:** Lidocaine creams or gels must be administered to unbroken skin for simple procedures. The onset of action often occurs within 30-60 minutes, rendering it appropriate for venipuncture, laser procedures, and laceration repair.
- **EMLA (Lidocaine and Prilocaine):** EMLA cream must be put under occlusion for a minimum of 60 minutes prior to treatments such as skin biopsies or needle insertions. It is crucial to monitor for indications of methemoglobinemia, especially in neonates and infants.
- **Capsaicin:** is intended for use in older children capable of enduring the initial searing sensation. Understanding this initial discomfort is essential for ensuring appropriate use and compliance in chronic pain management.
- **Tetracaine:** Ametop gel must be administered 30-45 minutes prior to procedures like venipuncture. It is advisable to monitor for localized irritation; nonetheless, the gel is generally well-tolerated.

Category	Topical analgesics	Studies	Efficacy	Safety	Clinical recommendations
Lidocaine	Lidocaine 4% cream, LMX 4% and 5% cream	Harman et al. (2013), Sobanko et al. (2012), Eichenfield & Cunningham (1999), Aiseosa et al. O. (2024)	Effective in reducing pain during venipuncture, laser treatments, laceration repair, and IV insertion in pediatric patients.	Common side effects include localized redness and irritation. Rare cases of systemic toxicity.	Apply to intact skin for minor procedures. Onset of action within 30-60 minutes.
Prilocaine	EMLA cream (Lidocaine and Prilocaine)	Zaki et al. (2022), Priestley et al. (2003)	Effective in reducing pain in skin biopsies and minor surgical procedures in pediatric patients.	Common side effects include localized redness and irritation. Rare but serious side effect is methemoglobinemia.	Apply under occlusion for at least 60 minutes before procedures like needle insertions. Monitor for signs of methemoglobinemia.
Capsaicin	Capsaicin cream	Rumsfield & West (1991), Gonzalez & Martinez (2021)	Effective in managing pain associated with post-herpetic neuralgia. Initial applications cause discomfort and burning sensations.	Irritative potential with significant burning and stinging. Effects diminish with repeated use.	Reserve for older children who can tolerate initial discomfort. Apply with caution and educate patients and caregivers about the initial burning sensation.
Tetracaine	Ametop gel	Taddio et al. (1997), Kouba et al. (2016)	Effective in providing analgesia for venipuncture and other minor procedures in pediatric patients.	Common side effects include localized redness and erythema. Rare systemic toxicity.	Apply to intact skin 30-45 minutes before procedures. Observe any signs of local irritation.

Conclusion

In conclusion, this review underscores the significance of topical analgesics in managing pain associated with pediatric dermatological conditions. These treatments offer effective and localized pain relief with minimal systemic involvement, making them suitable for young patients. The evidence supports their efficacy and safety, although careful application and monitoring are essential. By integrating these topical analgesics into clinical

practice, healthcare practitioners can enhance pain management and improve the overall care of pediatric patients with dermatological conditions.

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