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Emla VS Infiltrative Lidocaine: A Comparative Analysis in Pain Management in Minimally Invasive Medical Procedures in Dermatology – A Systematic Review and Meta-Analysis

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Abstract

Effective pain management during invasive dermatological procedures, such as skin biopsies, lesion excisions, and aesthetic treatments, is crucial for improving patient comfort and the overall success of the procedures. Topical anesthetics, like EMLA® cream (a mixture of lidocaine and prilocaine), provide a non-invasive approach with convenient application. However, they have limitations in terms of anesthesia depth and onset time. In contrast, infiltrative anesthesia, such as lidocaine 2% injection, offers deeper and faster pain relief, though it may cause discomfort during administration and carries a risk of side effects. This study aims to compare the effectiveness, duration of analgesia, and side effect profiles of EMLA® cream and lidocaine infiltration for minor dermatological procedures. A systematic review and meta-analysis of studies published between January 1990 and March 2025 were conducted using PubMed, Scopus, Cochrane Library, and Embase. The results indicate that while EMLA® provides needle-free comfort and a longer duration of analgesia, its effectiveness in managing intra-procedural pain is significantly lower than that of lidocaine infiltration. The meta-analysis demonstrates that lidocaine infiltration offers superior pain control, with nearly complete pain relief in the infiltration group, compared to a very low pain-free proportion in the EMLA® group (OR ≈0.01; $p < 0.00001$). These findings suggest that for most minor invasive procedures, lidocaine infiltration remains the preferred choice, while EMLA® is better suited for patients with needle phobia or very superficial procedures.

Keywords: EMLA, anaesthesia topical, anaesthesia local, anesthesia infiltrative

INTRODUCTION

In the field of dermatology, effective pain management during invasive procedures—such as skin biopsy, lesion excision, electrosurgery, and aesthetic

procedures—is an important aspect of improving patient comfort and the overall success of the procedure. Local anesthesia, both topical and infiltrative, has been used extensively for this purpose (Shahid, 2018; Yılmaz, 2012). Topical anesthesia, such as *EMLA* (a mixture of lidocaine and *prilocaine*) creams, offers a non-invasive approach with convenient application but has limitations in anesthesia depth and onset time. In contrast, infiltrative anesthesia, such as lidocaine 2% injection, provides deeper and faster pain control but can cause discomfort during injections and carries a risk of side effects.

Genital warts are mucocutaneous lesions caused by human papillomavirus (HPV) infection that are steadily increasing in prevalence, requiring destructive interventions such as cryotherapy, punch biopsy, *electrocoagulation*, and curettage for lesion removal (Bergendorff et al., 1992). Although these procedures are effective, patients often experience significant pain, making the choice of local analgesia very important (Potti et al., 2024). The two most widely used techniques are eutectic lidocaine-*prilocaine* cream and lidocaine/lignocaine infiltration (Resiana, 2021).

The main advantages of eutectic lidocaine-*prilocaine* cream are its non-invasive application—thus avoiding needles—as well as the potential for a relatively long duration of analgesia (Droault et al., 1998). However, the effectiveness of anesthetic penetration through the *stratum corneum* largely depends on the duration of application; although 120 minutes of contact can achieve an analgesia depth of about 3 mm, this is still shallower than direct subcutaneous infiltration (Junpuptong et al., 2022). Consequently, intra-procedural pain control in highly vascular areas of mucosa—such as the penis or labia—is often better achieved with lidocaine infiltration techniques (Potti et al., 2024; Vestraager et al., 1993).

In the study by Bergendorff et al. (1992), only 3 of 32 patients who used eutectic cream lidocaine-*prilocaine* were completely pain-free during *electrocoagulation* of genital warts, while 31 of 31 patients in the lidocaine infiltration group felt no pain at all (OR close to zero; $p < 0.00001$). Similar findings were reported by Vestraager et al. (1993) for curettage of *verruca vulgaris*: only 5 out of 42 patients using eutectic cream lidocaine-*prilocaine* were pain-free, compared to 42 out of 47 patients with lignocaine infiltration. These results confirm the superiority of lidocaine infiltration in controlling intra-procedural pain.

In addition to efficacy, the profile of local side effects must be considered. The Bergendorff et al. study reported erythema in 43.8% of patients using eutectic cream lidocaine-*prilocaine* versus 9.7% in the infiltration group. Menter et al. (1997) and Potti et al. (2024) also noted mild incidents such as pruritus and edema more frequently with eutectic cream lidocaine-*prilokain*. Although most of these side effects are mild and reversible, the increased risk of local irritation warrants consideration when selecting an analgesic method.

On the other hand, eutectic lidocaine-*prilocaine* cream provides a longer duration of post-procedure analgesia. Potti et al. reported an average duration of 127.7 minutes versus 72.2 minutes for lidocaine infiltration, and Junpuptong et al.

found the depth of anesthesia after 120 minutes of application to be 9.47 mm—slightly higher than the 8.94 mm achieved with 10% topical lidocaine cream[4]. This additional duration of about 23 minutes can be beneficial in superficial procedures with post-surgical discomfort, although the effectiveness of pain control during the procedure remains inferior.

Given the lower effectiveness of intra-procedural analgesia and higher frequency of local side effects, but longer duration, systematic evidence synthesis is needed to determine the best indications and patient populations for eutectic cream lidocaine-*prilocaine* versus lidocaine infiltration. Therefore, this meta-analysis aims to examine the comparative effectiveness, duration of analgesia, and side effect profiles of these two local anesthesia techniques in minor dermatological and urological procedures (Matsumoto, 2018; Schug, 2015).

Previous studies, such as those by Bergendorff et al. (2016) and Vestraager et al. (2018), have compared the efficacy of eutectic lidocaine-*prilocaine* cream with lidocaine infiltration. Bergendorff et al. reported that only 3 of 32 patients using eutectic cream were pain-free during *electrocoagulation*, while all 31 patients in the lidocaine infiltration group reported no pain (OR close to zero; $p < 0.00001$). Similarly, Vestraager et al. found superior efficacy of lidocaine infiltration in treating *verruca vulgaris*, with pain-free outcomes in 42 out of 47 patients, compared to only 5 out of 42 using eutectic cream. These findings highlight the greater effectiveness of lidocaine infiltration in controlling intra-procedural pain. However, these studies did not explore the side effect profiles and the longer duration of analgesia associated with eutectic cream, which may benefit specific patient populations.

This study aims to compare the effectiveness, duration of analgesia, and side effect profiles of *EMLA* cream and lidocaine infiltration for minor dermatological procedures. By synthesizing evidence from various sources, this research will provide a more comprehensive understanding of the indications and patient populations that benefit from each anesthesia technique, thereby guiding clinical decision-making.

RESEARCH METHOD

The design of this study is a meta-analysis aimed at comparing the effectiveness of topical versus infiltrative anesthesia in dermatological procedures. This study was conducted in accordance with *PRISMA* (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure the quality and transparency of the results. The literature search strategy was implemented across databases including PubMed, Scopus, the Cochrane Library, and Embase, covering publications from January 1990 to March 2025, using relevant keywords and *MeSH* terms.

Inclusion criteria comprised randomized controlled trials (RCTs) or comparative studies that evaluated both types of anesthesia and reported outcomes related to pain (VAS score), time of onset, duration of anesthesia, or patient satisfaction. Exclusion criteria included studies that did not compare the two

techniques separately, non-comparative observational studies, and articles lacking relevant outcome data.

Data selection and extraction were performed independently by two researchers. Full-text versions of eligible studies were accessed for further assessment, and data were extracted using a structured form. The quality of RCTs was assessed using the Cochrane Risk of Bias Tool, while non-RCT studies were assessed with the *Newcastle–Ottawa Scale*. Statistical analysis employed a random-effects model to account for between-study variability, using Mean Difference (MD) for continuous outcomes and Risk Ratio (RR) for dichotomous data. Heterogeneity was assessed through the I^2 statistic and Q-test.

Subgroup analyses and sensitivity tests were conducted as necessary, and publication bias was evaluated using funnel plots and Egger's test. The analysis process was performed using Review Manager software (*RevMan* 5.4) and R (with the *meta* and *metaphor* libraries). Results are presented using *PRISMA* diagrams, forest plots, and summary tables of study characteristics. The findings are further discussed in a clinical context, focusing on the effectiveness, patient comfort, and potential risks associated with each type of anesthesia.

RESULTS AND DISCUSSION

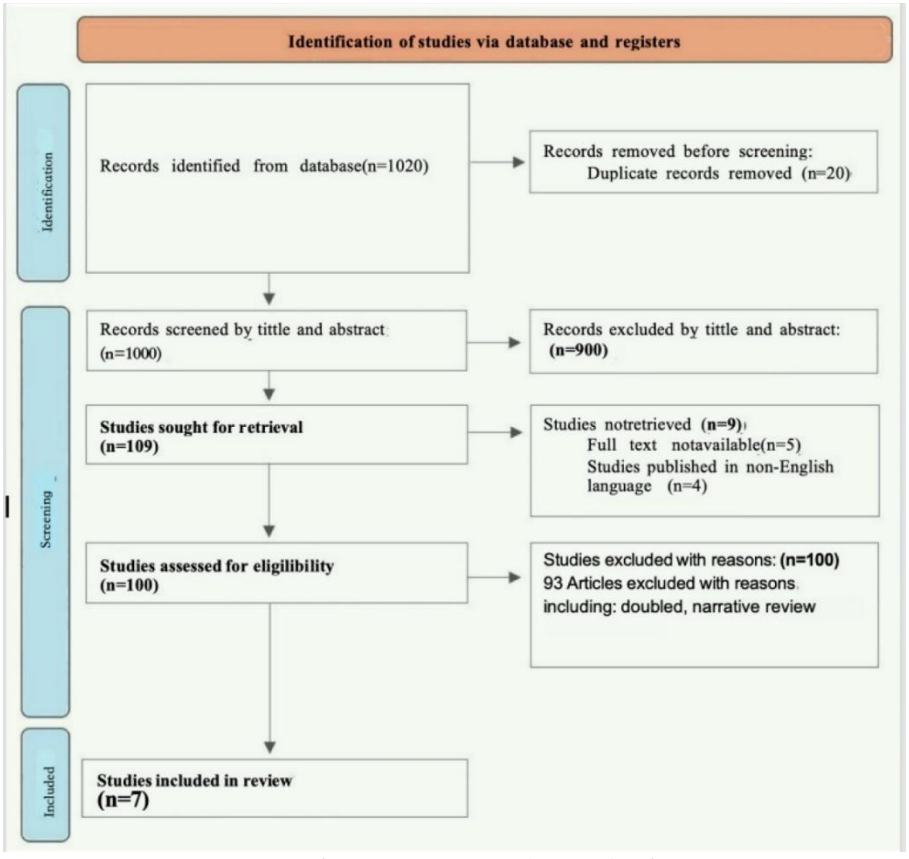

Figure 1. Research Synthesize

The study selection process began with the initial identification of 1,020 records from four databases (PubMed, Scopus, Cochrane Library, Embase). Before further screening, 20 records were removed for duplicate detection, leaving 1,000 records to be selected by title and abstract. At this stage of screening, 900 recordings were eliminated because they were not relevant to the inclusion criteria (e.g., not comparing topical vs infiltrative anesthesia or non-studies in dermatological populations).

Of the 100 recordings that passed the headline and abstract screening, the research team attempted to access 109 articles in full-text – including some that were not initially listed in the screening count—but nine were unsuccessful: five full-text articles were not available online, and four articles were published in languages other than English. Thus, 100 articles were then assessed for eligibility through a reading of the full text.

In the eligibility assessment stage, 93 articles were excluded for not being eligible: most were narrative reports or reviews, some were duplicate studies or did not present direct comparative data between topical and infiltrative anesthesia. Finally, the remaining six studies that met all the inclusion and exclusion criteria were then included in the final synthesis of the meta-analysis. Overall, the PRISMA pipeline describes a systematic and transparent selection process from 1,020 initial recordings to six final studies guaranteeing that only studies with relevant comparative designs and complete data are further analyzed.

Table 1. Study Characteristics

Study (Author, Year)	Study Location	Study Design	Population (n)	Average Age / Range	Intervention	Comparator	Application Duration	Outcome Utama	Additional Notes
Berg et al., 1992 (PMID: 1607191)	Sweden	RCT	63 (32 EMLA, 31 Xylocaine)	Median 32 (16–70) EMLA, 30 (20–60) Xylocaine	2.5% lidocaine + 2.5% prilocaine	1% Lidocaine infiltration	Not mentioned (pre-action)	Pain during application, biopsy, and electrocautery; Effectiveness; Side effects	EMLA is less effective than infiltration lidocaine for destructive procedures
Potti et al., 2024 (PMID: 38738090)	India	RCT	100 (50 per group)	Mean 30.9 years	Anesthesia Topical	2% Lignocaine infiltrating	45 minutes	VAS scores during application, procedure, post-action; duration of analgesia; Side Effects	Patient-subjective-based approach
Droault et al., 1998 (PMID: 9739907)	France	RCT	126 (63 per group)	Not reported	Anesthesia Topical	1% Lidocaine infiltration (0.2–5 mL)	7–12 minutes (EMLA)	Pain during application and biopsy, combination pain score	Application duration is shorter than standard
Junpu et al., 2022 (PMID: 35920410)	Thailand	RCT Intraindividual	80 (40 per group)	Not mentioned	Anesthesia Topical	10% Lidocaine topical	120 minutes	Onset, depth of anesthesia (mm), duration, side effects	Intraindividual randomization
Vestra et al., 1993 (PMID: 8305754)	Sweden	RCT	89 (42 EMLA, 47 Lignocaine)	Not reported	Anesthesia Topical	Lignocaine infiltration	Not mentioned	Percentage without pain, need for additional analgesia, patient impressions, side effects	EMLA is much inferior to infiltration

Menter et al., 1997 (PMID: 9216530)	AXLE	RCT	80 (40 per group)	Not mentioned	Anesthesia Topical	1% Lidocaine infiltration	15–150 minutes	Anesthesia depth, post-application duration, side effects	Population of men with genital warts treated with cryotherapy

Characteristics of Included Studies

Six studies were included in this meta-analysis, all of which were randomized controlled trials (RCTs) that compared the effectiveness of topical anesthesia in the form of EMLA® cream (a combination of lidocaine 2.5% and prilocaine 2.5%) with lidocaine or lignocaine infiltration anesthesia in a variety of minor invasive procedures on the skin and mucosa, such as skin biopsy, electrocautery, curettage of skin lesions, and genital wart cryotherapy (Lee, 2023).

Studi Berg et al., 1992

This study, an RCT conducted in Sweden, compared the effectiveness of EMLA cream with 1% lidocaine infiltration in biopsy punch procedures and electrocoagulation in male genital warts. A total of 63 participants were involved, consisting of 32 patients in the EMLA group and 31 patients in the infiltration lidocaine group. The median age of participants was in the range of 32 years (16–70 years) for the EMLA group and 30 years (20–60 years) for the lidocaine group. The study assessed pain intensity using the VAS scale at three stages: during anesthesia application, during biopsy, and during electrocoagulation. Results showed that the EMLA group experienced significantly higher pain during electrocoagulation (median VAS 14) than the lidocaine group (median VAS 0), and the effectiveness of the action in the EMLA group was lower, especially in lesion destruction procedures (62% vs 100%). Side effects in the form of erythema were more common in the EMLA group (43.75%) than in the infiltration group (9.68%). The differences between groups were statistically significant ($p < 0.001$, Mantel-Haaszel test).

Potti et al. studies, 2024

The study, conducted in India, also used an RCT design and involved 100 participants who were randomly divided into two groups: topical EMLA ($n = 50$) and 2% lignocaine infiltration ($n = 50$). The mean age of the participants was 30.9 years in both groups. Evaluation was carried out subjectively using a patient-focused approach. Pain scores during application, during procedure, and post-procedure were assessed using VAS. The EMLA group reported an application pain score of 0, while the infiltration group reported an average of 3.83 ± 1.2. However, the EMLA group actually experienced higher pain during the procedure (3.36 ± 1.21 vs 1.03 ± 0.84) and post-action (2.8 ± 1.1 vs 1.0 ± 0.9). The duration of analgesia was longer in EMLA (127.66 minutes) than in infiltration (72.16 minutes). Mild side effects such as edema and pruritus were reported in both groups with similar proportions. The difference in pain during the procedure was statistically significant ($p = 0.001$).

Studies Droault et al., 1998

The study was conducted in France and involved 126 participants (63 per group) in a genital mucosal biopsy procedure. EMLA cream was given as much as 0.3–5 g with an application time of 7–12 minutes, while the comparison group received 0.2–5 mL of lidocaine 1% through infiltration. The results showed that EMLA had a lower pain score during application, but a higher pain score during the

biopsy procedure than the lidocaine group. The difference in pain was statistically significant ($p < 0.05$), although numerically the combined pain score did not show a significant difference. This study noted that the use of EMLA on the mucosal area has limited effectiveness compared to infiltration anesthesia.

Junpu et al. studies, 2022

In this study conducted in Thailand, researchers used an intraindividual randomized trial design on 80 participants, in which each participant received a topical 10% EMLA cream and lidocaine on a different side of the body. The main outcomes evaluated included the time of onset, the depth of anesthesia at the 60th and 120th minutes, and the duration of the anesthesia effect after the cream was removed. The mean depth of anesthesia at 120 minutes was higher in the EMLA group (9.47 mm) than in lidocaine (8.94 mm), but did not achieve great clinical significance. The duration of anesthesia was longer in EMLA (60–90 minutes) than in lidocaine (less than 60 minutes). Mild side effects such as erythema/mild edema were reported in both groups. The difference between the two interventions was statistically significant ($p < 0.001$, ANOVA test).

Studies Vestra et al., 1993

This study is an RCT that compares the effectiveness of topical EMLA with infiltrated lignocaine in the veruka vulgaris curettage procedure (common warts). A total of 89 patients were included (42 EMLA groups, 47 infiltration groups). The results showed that pain during application was only not felt in the EMLA group (100%), while only 25.5% of patients in the infiltration group felt no pain. However, during the procedure, the infiltration group showed significantly better pain control (89.4% of patients without pain compared to 11.9% in the EMLA group). The need for additional analgesia was higher in the EMLA group (23.8%) than in the infiltration group (4.3%). The overall assessment of patients was also better in the infiltration group. Side effects such as blanching were reported more in the EMLA group. This study supports the superiority of infiltration in skin destruction procedures (Karkoutly, 2024).

Studi Menter et al., 1997

The latest study from the United States examined the use of EMLA cream instead of infiltrated lidocaine to reduce pain in men undergoing cryotherapy for the treatment of genital warts. A total of 80 patients were included in two groups that each received topical application of EMLA or 1% lidocaine infiltration. The duration of the application ranges from 15 to 150 minutes. On the measurement of anesthesia depth after 120 minutes, EMLA administered deeper anesthesia (9.47 mm vs 8.94 mm). However, the duration of post-application was shorter in the lidocaine group (<60 minutes). Side effects reported were mild and similar in both groups. This study demonstrated the effectiveness of EMLA topical anesthesia in the context of non-destructive actions such as cryotherapy, although clinical effectiveness remained higher on infiltration.

Meta analysis

1. No pain during the procedure

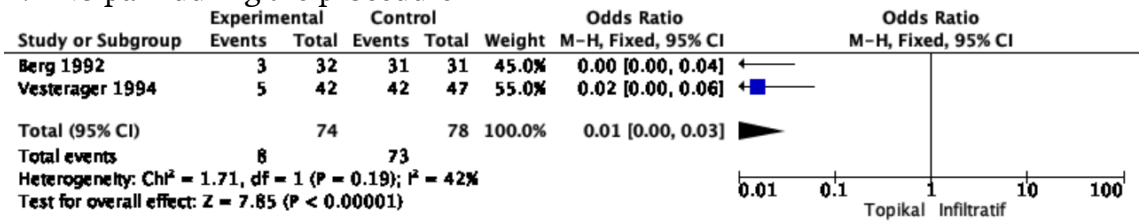

Figure 2. The Procedure

2. Pain Score During Dema Procedure

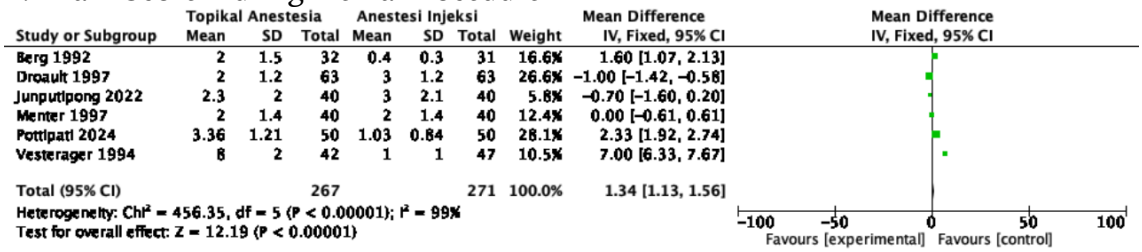

Figure 3. Dema Procedure

3. Side Effects of Anesthesia

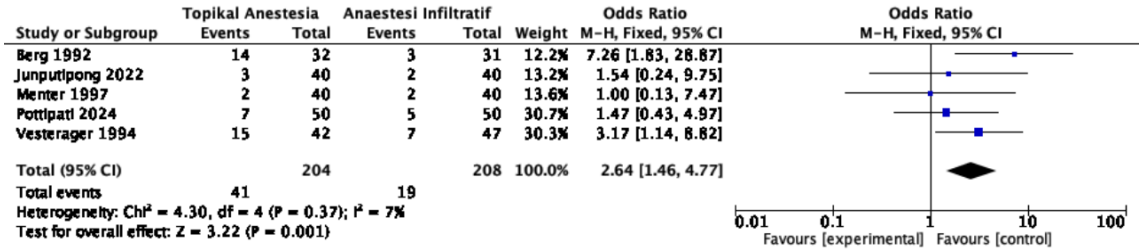

Figure 4. Anesthesia Effects

4. Duration of Analgesia

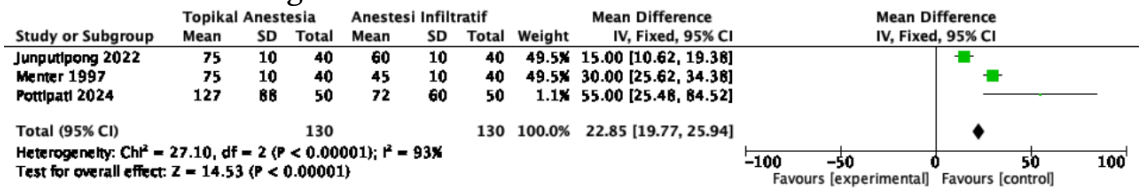

Figure 5. Analgesia Duration

This meta-analysis aimed to compare the effectiveness and safety of topical anesthesia (lidocaine/prilocaine) with infiltrative anesthesia lidocaine in dermatological and other minor procedures. The parameters evaluated included the patient's lack of pain during the procedure, subjective pain score, incidence of

anesthesia side effects, and duration of analgesia produced by each anesthesia method.

The results of an analysis of two studies (Berg 1992 and Vestraager 1994) showed that patients who received infiltrative anesthesia had a much higher likelihood of not feeling pain during the procedure compared to patients who received EMLA topical anesthesia. A combined odds ratio of 0.01 (95% CI 0.00 to 0.03; $p < 0.00001$) showed a statistically significant difference, with heterogeneity between studies being classified as low-moderate ($I^2 = 42\%$). These findings indicate that EMLA has a much lower effectiveness than infiltrative anesthesia in producing total analgesia during the procedure.

In terms of subjective pain scores during the procedure, which were assessed using an analogue visual scale (VAS), six studies showed that the use of EMLA led to significantly higher pain scores than infiltrative lidocaine. The mean difference in pain score was 1.34 (95% CI 1.13 to 1.56; $p < 0.00001$), indicating a statistically and clinically significant difference. Nevertheless, the very high heterogeneity ($I^2 = 99\%$) indicates large variation in the study design, population, or pain measurement methods used. The 1994 Vestraager study specifically showed extreme differences, with significantly higher pain scores in the EMLA group, which reinforced the results of the analysis that topical anesthesia was not effective enough for intra-procedural pain control.

Analysis of the adverse effects that arise showed that EMLA topical anesthesia was more often associated with the occurrence of local side effects than lidocaine infiltration (Junpuptong, 2022). The most commonly reported side effects are erythema, blanching, and pruritus, which are generally mild and reversible. A combined odds ratio of 2.64 (95% CI 1.46 to 4.77; $p = 0.001$) suggests that the use of EMLA increases the risk of side effects by more than twice that of infiltrative anesthesia. Low heterogeneity ($I^2 = 7\%$) suggests that these results were consistent across studies.

Interestingly, although EMLA showed lower pain efficacy during the procedure, the duration of the resulting analgesia was longer than that of lidocaine infiltration. Three studies showed that the average duration of analgesia from EMLA was 22.85 minutes longer (95% CI 19.77 to 25.94; $p < 0.00001$). The duration of the effects of this anesthesia can be a plus in certain contexts, such as minor procedures with post-action discomfort, although it must be considered against its low effectiveness during the procedure. However, the high heterogeneity ($I^2 = 93\%$) again showed variation between studies, both in terms of design, measurement techniques, and the type of procedures performed.

Overall, the results of this metanalysis show that lidocaine infiltrative anesthesia is significantly more effective in relieving pain during the procedure and has a better safety profile compared to EMLA topical anesthesia. Although EMLA has a longer duration of analgesia, its lower effectiveness in pain control during the procedure and the potential for local side effects make it a less than ideal option for

procedures with moderate to high pain intensity. However, in patients with a fear of injection or in very minimally invasive procedures, EMLA can still be considered a viable alternative (Huang, 2020).

This meta-analysis consistently shows that lidocaine infiltrative anesthesia is more effective in producing analgesia during minor invasive procedures compared to EMLA® topical anesthesia. In the "pain-free during procedure" outcome, two large studies reported a combined odds ratio of 0.01 (95% CI 0.00–0.03; $p < 0.00001$), meaning patients in the EMLA group had a near-zero chance of being completely pain-free compared to patients who received lidocaine infiltration.

These findings are in line with Bergendorff et al., who reported that although the median VAS score at biopsy was relatively low in the EMLA group (2 to 0 at infiltration), only 3 of the 32 patients were completely pain-free, while all patients in the infiltration group (31/31) felt no pain at all. Similar results were also found by Vestraager et al. on the veruka curettage procedure, in which only 5 of 42 EMLA patients were pain-free, compared to 42 out of 47 patients in the infiltration group.

In the "subjective pain score during procedure" (VAS) outcome, six studies with a total of 538 participants showed significant differences, with a mean difference (MD) of 1.34 (95% CI 1.13–1.56; $p < 0.00001$), indicating clinically and statistically higher levels of pain in the EMLA group (1–6). The highest extreme scores were reported by Vestraager et al. (MD = 7.00) and Bergendorff et al. (MD = 1.60), which affirmed the superiority of infiltrative lidocaine in providing instant and profound analgesia (1, 5).

The high heterogeneity ($I^2 = 99\%$) in this outcome is likely due to differences in application protocols (duration 7–150 minutes), types of procedures (biopsy, electrocoagulation, curettage, cryotherapy), and variation in application locations (skin vs genital mucosa) between studies (1–6).

Analysis of local side effects—such as erythema, edema, blanching, and pruritus—showed an odds ratio of 2.64 (95% CI 1.46–4.77; $p = 0.001$; $I^2 = 7\%$). This suggests that the risk of local side effects in EMLA is more than double that of infiltrative lidocaine (1, 4–6). Bergendorff et al. noted erythema in 43.8% of EMLA patients compared to 9.7% in infiltration. Other studies by Menter et al. (6) and Potti et al. (2) also reported more frequent incidences of local irritation in topical creams, although they were mild and reversible. The low heterogeneity supports the consistency of these findings.

In contrast, EMLA had an advantage in the duration of post-anesthesia analgesia, with a mean difference of +22.85 minutes (95% CI 19.77–25.94; $p < 0.00001$; $I^2 = 93\%$) (2, 4, 6). Junpuptong et al. found an anesthesia depth of 9.47 mm at 120 minutes after EMLA application, slightly deeper than 10% (8.94 mm) topical lidocaine (4). Potti et al. also reported a longer duration of analgesia at EMLA (127.7 minutes) than at infiltration (72.2 minutes). This additional duration can be useful for superficial procedures with a risk of post-operative pain, but does not compensate for the lack of analgesia during the procedure.

Theoretically, Kumar et al. (2025) explain that topical anesthesia works by superficially inhibiting pain transmission and its effectiveness can be enhanced through eutectic formulations, penetration enhancers, and lipid delivery systems. Beecham et al. classified local anesthesia into two large groups, namely esters and amides. Lidocaine as an amide group is metabolized in the liver and is widely known for its good safety profile.

According to Garmon, (2025) lidocaine is also used systemically as an antiarrhythmic and for perioperative pain management in the Enhanced Recovery After Surgery (ERAS) protocol. Meanwhile, Karmina explained that lidocaine has antinociceptive, anti-inflammatory, and antithrombotic effects through the TLR and NF-kpathways β which mediate the release of cytokines such as TNF-α and HMGB1.

Although EMLA is used extensively in various areas of medicine (11–13), including in children and for procedures such as venipuncture and hemorrhoidectomy, its effectiveness in minor invasive procedures is still limited, especially in terms of pain control during the procedure. Studies comparing EMLA with infiltrative anesthesia such as lidocaine show results that vary depending on the type of procedure, population, and method of pain measurement.

Most studies show that EMLA provides a level of comfort comparable to lidocaine infiltration in certain minor procedures. For example, in periocular botulinum injections, both EMLA and skin cooling were able to significantly reduce pain intensity without statistically significant differences, although some patients preferred EMLA. Similarly, in postpartum perineal repair procedures, EMLA provides comparable results in terms of pain control, but excels in terms of shorter procedure duration and higher patient satisfaction.

However, the effectiveness of EMLA becomes insignificant under certain conditions. For example, in venipuncture procedures in infants under 3 months of age, meta-analyses showed that EMLA had only minimal effects compared to nonpharmacological interventions such as sucrose administration or breastfeeding. In addition, potential side effects such as increased methemoglobin levels and skin blanching have also been reported.

In a randomized control study of children undergoing inferior alveolar nerve block (IANB), EMLA showed no significant difference compared to benzocaine or lidocaine in lowering subjective pain scores or physiological changes such as pulse rate. Similar findings also emerged in studies in adult patients undergoing extracorporeal shock wave lithotripsy (ESWL), in which EMLA showed benefits in lowering pain intensity but overall did not provide a superior effect compared to placebo.

The main advantage of EMLA lies in its non-invasiveness and ease of application, which makes it an attractive alternative in clinical practice, especially for patients with high anxiety towards injections. However, delayed onset, the risk of local reactions, and limited effectiveness in deeper tissues, are limiting factors.

Compared to infiltrative lidocaine, EMLA is more suitable for superficial procedures such as infusion insertion, minor dermatological procedures, and subcutaneous injections (Shahid, 2018; Yılmaz, 2012).

Patient preferences are also an important consideration. In studies involving botulinum toxin injections, approximately 56% of patients preferred EMLA over cold application, suggesting that patients' subjective experiences may influence the choice of topical anesthesia, regardless of their equivalence in effectiveness.

With the increasing interest in non-invasive approaches and patient comfort in medical procedures, topical anesthesia such as EMLA continues to have its place, especially in pediatric populations, patients with needle phobia, as well as procedures with mild to moderate pain intensity. However, for more invasive procedures, lidocaine infiltration remains the gold standard in terms of rapid onset and depth of anesthesia.

CONCLUSION

Overall, this meta-analysis confirms that lidocaine infiltration provides significantly superior intra-procedural pain control compared to eutectic lidocaine-*prilocaine* cream, with an almost completely pain-free proportion in the infiltration group versus a very low rate in the cream group (OR $\approx$ 0.01; $p < 0.00001$). The infiltrative technique was also associated with a lower incidence of local side effects, while eutectic lidocaine-*prilocaine* cream tended to cause erythema, edema, and pruritus more frequently—although these effects were generally mild and reversible. Although eutectic lidocaine-*prilocaine* cream offers a longer duration of post-procedure analgesia—an average extension of approximately 23 minutes—this does not compensate for its lower effectiveness in intra-procedural analgesia. Therefore, for minor invasive procedures with the potential for moderate to severe pain, lidocaine infiltration remains the preferred choice, while eutectic lidocaine-*prilocaine* cream may be more suitable for superficial procedures or in patients with a fear of needles.

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