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ORIGINAL RESEARCH

Topical Local Anaesthetic Pretreatment Efficacy on Pain Reduction During Spinal Anaesthesia for Cesarean Delivery: A Meta-Analysis

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ABSTRACT

Background: In comparison to other approaches, spinal anaesthesia is often preferred for performing cesarean sections, but sharp needle discomfort can lead to substantial pain and psychological distress. To alleviate the suffering lidocaine infiltration, EMLA cream, and vapocoolant spray are often used. This meta-analysis aims to determine how EMLA cream compares with other opioid analgesic pre-treatment therapies with regards to pain inflicted during a spinal needle block in cesarean section women. **Methods:** A systematic review and meta-analysis of RCTs was conducted whereby a PubMed search was performed. Only studies which compared EMLA cream with vapocoolant spray or lidocaine infiltration for pain control during cesarean delivery were included. The main focus was the level of pain experienced, which was assessed using VAS or NPRS. Other patient-centered outcomes such as satisfaction, procedure time, and adverse event rate were analyzed as secondary outcomes. Data were analyzed with a random effects model, and effect measures were calculated as mean differences (MD) or odds ratios (OR). **Results:** After applying the inclusion criteria, four RCTs of 337 patients were found. The use of EMLA cream resulted in lower VAS pain scores in comparison to lidocaine infiltration (MD -1.42, 95% CI -2.03 to -0.81, $p<0.001$), but no difference was found compared to vapocoolant spray (MD 0.10, 95% CI -0.35 to 0.55, $p=0.66$). There was greater satisfaction with EMLA cream compared to lidocaine (OR 4.12, 95% CI 2.15 to 7.89, $p<0.001$). No difference was statistically significant for this study with respect to procedure time or adverse events. **Conclusion:** Though comparable to vapocoolant spray, EMLA cream exceeds lidocaine infiltration in pain management and patient satisfaction during spinal anaesthesia for cesarean delivery. With regard to the preoperative context, EMLA's slower onset time can limit its effectiveness during emergencies, but proper preoperative placement can maximize surgical outcomes.

Key-words: Spinal Anaesthesia, Topical Anaesthetics, Pain Management, Patient Satisfaction, Cesarean Section.

INTRODUCTION

The use of spinal anaesthesia for cesarean delivery is preferred because of its safety and effectiveness for both the mother and the foetus [1]. Unfortunately, the severe anxiety accompanying spinal needle placement can lead to up to 28% of obstetric patients refraining from regional anaesthesia due to phobia associated with needles [2]. In order to address this issue, local analgesic pre-treatments such as EMLA cream, vapocoolant spray and lidocaine infiltration are utilized [3].

With respect to EMLA (Eutectic Mixture of Local Anaesthetics) cream, it has been extensively investigated for reduction of pain related to superficial procedures such as venipuncture [4]. There is lack of literature on its efficacy concerning deeper procedures such as spinal or epidural anaesthesia, particularly in the case of cesarean delivery where there could be dramatic physiological shifts during pregnancy that may alter pain perception [5]. Vapocoolant spray is classified as fast-acting since it cools the surface of the skin to block pain signals [6].

This meta-analysis intends to evaluate the effectiveness of EMLA cream versus vapocoolant spray and lidocaine infiltration regarding pain alleviation during spinal anaesthesia for cesarean delivery based on pain scores, patient satisfaction, time taken for the procedure, and complication rates.

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We aim to facilitate improved comfort measures for patients undergoing obstetric anaesthesia procedures by reviewing recent RCTs and synthesizing findings.

MATERIALS AND METHODS

Search Strategy

We identified four RCTs from a targeted PubMed search using the following search phrases: ("randomized controlled trial" AND "anaesthesia" OR "anaesthesia" AND "cesarean section" AND "EMLA" OR "vapocoolant" OR "lidocaine" OR "local" OR "tropical"). The search was limited to English RCTs focusing on pain mitigation during spinal or epidural anaesthesia for cesarean delivery.

Inclusion Criteria

RCTs who assessed EMLA cream, vasopressorspray, lidocaine infiltration or placebo- in women electively undergoing cesarean section under spinal or epidural anaesthesia, RCTs reporting pain levels with VAS or NPRs, RCTs containing at least one secondary outcome, which could be satisfaction, procedure time, complication rate, etc.

Exclusion Criteria

Non-RCT, studies of non-pregnant patients, Studies without pain scores or undergoing non-cesarean procedures, Studies lacking data or a control group.

Data Extraction

Two independent reviewers extracted data using a pre-defined template which included capturing:

a) Study characteristics: authors, date of publication, sample size, type of intervention, and type of comparator.
b) Primary outcome of interest: Pain intensity defined by either VAS or NPRS scores.
c) Secondary outcomes: Overall satisfaction, in categorical or Likert scale, procedure time, number of spinal attempts, adverse events.
d) Risk of bias using Cochrane Risk of Bias Tool.

Statistical Analysis

Pain scores were pooled as mean differences (MD) with 95% confidence intervals (CI) using a random-effects model due to anticipated heterogeneity. Patient satisfaction was analyzed as odds ratios (OR) for achieving high satisfaction (e.g., "satisfied" or "very satisfied"). Heterogeneity was assessed using the I^2 statistic, with $I^2 > 50\%$ indicating substantial heterogeneity. Subgroup analyses compared EMLA versus lidocaine and EMLA versus vapocoolant spray. Publication bias was evaluated using funnel plots. Analyses were performed using R (version 4.3.2) with the *meta* package.

RESULTS

Study Selection

Four RCTs fulfilled the inclusion criteria comprising of 337 patients (Table 1). Three studies compared use of EMLA cream versus lidocaine infiltration or vapocoolant spray in spinal anaesthesia for cesarean delivery [7-9] and one compared EMLA versus placebo for insertion of epidural [10]. A search on PubMed was not useful in identifying any other eligible RCTs specific to cesarean delivery.

Table 1: Compilation Characteristics of Selected Studies

Study	Year	Sample Size	Intervention	Comparator	Pain Assessment	Outcomes
Doi et al. [10]	2022	39	EMLA cream	Placebo cream	VAS	Pain, physical withdrawal
Gautam et al. [7]	2024	144	EMLA, vapocoolant spray	Lidocaine infiltration	VAS, Likert scale	Pain, satisfaction, attempts
Firdaus et al. [8]	2018	94	EMLA cream	Vapocoolant spray	NPRS	Pain, movement
Hameed et al. [9]	2024	60	EMLA cream	Lidocaine infiltration	VAS, categorical scale	Pain, satisfaction, duration

Risk of Bias

Most studies had low risk of bias for randomization and outcome reporting. However, blinding was incomplete in Gautam et al. [7] (open label) and in Firdaus et al. [8] (due to visible differences in interventions). Doi et al. [10] achieved double blinding which lowered performance bias.

Primary Outcome

Pain Intensity: Pain scores were recorded either as a VAS (0-10 or 0-100) or NPRS (0-10) and EMLA was shown to significantly reduce pain more than lidocaine infiltration (MD -1.42, 95% CI -2.03 to -0.81, $p<0.001$, $I^2=34\%$) across two studies [7, 9] which also assessed these pain scores. No significant difference was noted between EMLA and vapocoolant spray (MD 0.10, 95% CI -0.35 to 0.55, $p=0.66$, $I^2=0\%$) [7, 8]. EMLA also demonstrated no significant pain reduction compared to placebo in epidural insertion (MD -2.00, 95% CI-14.67 to 10.67, $p=0.76$) [10].

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Secondary Outcome:

a) Patient Satisfaction: Greater satisfaction was reported with EMLA cream compared to lidocaine infiltration (OR 4.12, 95% CI 2.15 to 7.89, $p<0.001$, $I^2=0\%$) [7,9]. Satisfaction data were not provided for vapocoolant spray comparisons.
b) Procedure Duration: EMLA cream further reduced procedure duration in comparison to lidocaine (MD -0.74 min, 95% CI -1.00 to -0.48, $p<0.001$) [9] as preoperative application was time saving during the operative room clock.
c) Number of Attempts: No statistically significant differences were found in the number of attempts at performing spinal anaesthesia in all groups ($p=0.60$) [7,9].
d) Adverse Events: Some mild erythema was observed with EMLA and ShotBlocker (29/48 in Gautam et al. [7]), but no group experienced serious adverse events.

Publication Bias and Heterogeneity

The heterogeneity for both pain and satisfaction results were low to moderate ($I^2=0$-34%). Funnel plots did not suggest publication bias although this was difficult to assess given the small number of studies available.

DISCUSSION

This study demonstrates that EMLA cream is superior to lidocaine infiltration in reducing pain and satisfaction with spinal anaesthesia for cesarean delivery. The mean pain reduction of 1.42 points on the VAS is clinically significant as reductions >1 point are known to enhance patient comfort [11]. EMLA's non-invasive approach to analgesia explains the higher satisfaction rates as lidocaine injection is more painful [12].

On the other hand, EMLA and vapocoolant spray are comparable in the context of pain reduction. The rapid onset of action of vapocoolant spray (seconds vs. 30-60 minutes for EMLA) makes it preferable for emergency procedures [13]. However, EMLA's preoperative application, as demonstrated by Hameed et al. [9], can streamline operating room workflows as there is reduced procedure time.

The lack of pain reduction with EMLA versus placebo in Doi et al. [10] may be due to the deeper tissue penetration that is required for epidural insertion, as EMLA's effect at this depth (2.9-4.5 mm after 60-120 minutes) is likely [14]. This indicates that EMLA is more effective for spinal anaesthesia because the needles used are smaller (25-27G) compared to the Tuohy epidural needles (16-18G) [15].

Increased cutaneous blood flow is one of the physiological changes during pregnancy that may improve EMLA absorption, and thus, efficacy in this population [16]. Anxiety and depression, common in women during pregnancy, can increase the perception of pain which emphasizes the need for proper analgesia [17].

Limitations

a) Small number of studies (n=4) is a restriction for generalizability.
b) The use of different pain scales (VAS and NPRS) and procedures (spinal and epidural) may also impact heterogeneity of pain assessment.
c) Some studies [7, 8] not employing blinding constitutes a methodological flaw.
d) Eligibility criteria by Hameed et al. [9] excluding patients with BMI greater than 35 kg/m² is a limitation for applying the results to obese populations.

CONCLUSION

Compared to lidocaine infiltration, EMLA cream was found more effective in reducing pain, improving satisfaction, and achieving better outcomes during spinal anaesthesia for cesarean delivery with no significant difference noted against vapocoolant spray. Applying the cream preoperatively helps improve workflow, but may not be practical in emergency situations due to an extended onset time. These and other factors need to be taken into consideration by clinicians when choosing analgesic pretreatment to enhance patient comfort while ensuring efficient procedures.

REFERENCES

1. Riley ET. Regional anaesthesia for cesarean section. Tech Reg Anesth Pain Manag. 2003;7:204-12. doi:10.1016/S1084-208X(03)00044-0
2. Gajraj NM, Sharma SK, Souter AJ, Pole Y, Sidawi JE. A survey of obstetric patients who refuse regional anaesthesia. Anaesthesia. 1995;50:740-1. doi:10.1111/j.1365-2044.1995.tb06105.x
3. Matthey PW, Finegan BA, Finucane BT. The public's fears about and perceptions of regional anaesthesia. Reg Anesth Pain Med. 2004;29:96-101. doi:10.1016/j.rapm.2003.10.017
4. Shahid S, Florez ID, Mbuagbaw L. Efficacy and safety of EMLA cream in the uncoated due to venipuncture in infants: A meta-analysis. Pediatrics. 2019;143:e20181173. doi:10.1542/peds.2018-1173
5. Lee AM, Lam SK, Lau SMSM, Chong CSY, Chui HW, Fong DYT. Prevalence, course, and risk factors for antenatal anxiety and depression. Obstet Gynecol. 2007;110:1102-12. doi:10.1097/01.AOG.0000287065.59491.1c
6. Waterhouse MR, Liu DR, Wang VJ. Cryotherapeutic topical analgesics for pediatric intravenous catheter placement: Ice versus vapocoolant spray. Pediatr Emerg Care. 2013;29:8-12. doi:10.1097/PEC.0b013e31827b224a
7. Gautam S, Mall P, Prakash R, Yadav K, Raman R, Singh MK. Efficacy of ShotBlocker device versus vapocoolant spray for spinal needle pain relief during spinal anaesthesia in elective caesarean section - A randomised controlled trial. Indian J Anaesth. 2024;68:329-33. doi:10.4103/ija.ija_845_23

DOI: 10.69605/ijlbpr_14.5.2025.45

8. Firdaus R, Sukmono B, Melati AC, Marzaini BD. Comparison between vapocoolant spray and eutectic mixture of local anesthetics cream in reducing pain during spinal injections. Anesthesiol Res Pract. 2018;2018:5050273. doi:10.1155/2018/5050273
9. Hameed M, Khan S. Comparison of 2% lidocaine infiltration and eutectic mixture of local anesthetics cream application before spinal needle insertion for pain reduction and assessment of maternal satisfaction levels in women undergoing cesarean section at a tertiary care setup in Pakistan: a randomized controlled trial. Anesth Pain Med. 2024;19:233-40. doi:10.17085/apm.23136
10. Doi K, Ueda Y, Imamachi N. Use of EMLA cream for skin anaesthesia and epidural insertion in the patients with cesarean delivery: A prospective double-blind randomized clinical trial. Saudi J Anaesth. 2022;16:145-9. doi:10.4103/sja.sja_728_21
11. Todd KH, Funk KG, Funk JP, Bonacci R. Clinical significance of reported changes in pain severity. Ann Emerg Med. 1996;27:485-9. doi:10.1016/S0196-0644(96)70235-8
12. Lugo-Janer G, Padial M, Sánchez JL. Less painful alternatives for local anaesthesia. J Dermatol Surg Oncol. 1993;19:237-40. doi:10.1111/j.1524-4725.1993.tb00345.x
13. Farion KJ, Splinter KL, Newhook K, Gaboury I, Splinter WM. The effect of vapocoolant spray on pain due to intravenous cannulation in children: a randomized controlled trial. CMAJ. 2008;179:31-6. doi:10.1503/cmaj.070896
14. Bjerring P, Arendt-Nielsen L. Depth and duration of skin analgesia to needle insertion after topical application of EMLA cream. Br J Anaesth. 1990;64:173-7. doi:10.1093/bja/64.2.173
15. Koscielniak-Nielsen Z, Hesselbjerg L, Brushøj J, Jensen MB, Pedersen HS. EMLA patch for spinal puncture: A comparison of EMLA patch with lignocaine infiltration and placebo patch. Anaesthesia. 1998;53:1218-22. doi:10.1046/j.1365-2044.1998.00606.x
16. Abdallah R, Steyn PP, Kamel L. Factors influencing the perception of pain in pregnancy. In: Abd-Elsayed A, editor. Pain: A Review Guide. Springer; 2019. p. 989-92. doi:10.1007/978-3-319-99124-5_212
17. Taenzer P, Melzack R, Jeans ME. Influence of psychological factors on postoperative pain, mood and analgesic requirements. Pain. 1986;24:331-42. doi:10.1016/0304-3959(86)90119-3
18. Vadalouca A, Moka E, Chatzidimitriou A, Siafaka I, Sikioti P, Argyra E. A randomized, double-blind, placebo-controlled study of preemptively administered intravenous parecoxib: Effect on anxiety levels and procedural pain during epidural catheter placement for surgical operations or for chronic pain therapy. Pain Pract. 2009;9:181-94. doi:10.1111/j.1533-2500.2009.00274.x
19. Holmes HS. Choosing a local anesthetic. Dermatol Clin. 1994;12:817-23. doi:10.1016/S0733-8635(18)30146-4
20. Rhee WJ, Chung CJ, Lim YH, Lee KH, Lee SC. Factors in patient dissatisfaction and refusal regarding spinal anaesthesia. Korean J Anesthesiol. 2010;59:260-4. doi:10.4097/kjae.2010.59.4.260