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# Perioperative modulation of mean arterial pressure, heart rate, and cough reflex: The role of topical anesthetics in surgical patients

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**ABSTRACT** **Background:** Endotracheal intubation and extubation are crucial procedures in surgical operations, and they are frequently linked with significant hemodynamic responses and cough reflexes, which can result in complications. The purpose of this study was to determine whether lidocaine/prilocaine cream (EMLA cream) was successful in regulating these responses. **Methods:** Three groups of patients were assigned to receive EMLA cream, lidocaine gel, or a placebo. Mean arterial pressure (MAP) and heart rate (HR) were the hemodynamic parameters that were recorded prior to induction, one minute after intubation, and during recovery. Additionally noted was the frequency of cough reflex during recovery. SPSS V. 27 was used to analyze the data, and both descriptive and inferential statistics were used. **Results:**In comparison to the placebo group, the EMLA cream group had significantly lower MAP and HR levels during the intraoperative and postoperative periods. The EMLA group had a mean MAP of 105.09 ± 14.178 mmHg during induction and 97.17 ± 13.796 mmHg during recovery, compared to 88.29 ± 15.356 mmHg and 98.34 ± 13.841 mmHg in the placebo group. The EMLA group had a mean heart rate of 96.23 ± 17.687 bpm during induction and 96.40 ± 16.518 bpm during recovery, compared to 85.20 ± 18.253 bpm and 88.40 ± 17.172 bpm in the placebo group. The EMLA group had a considerably lower incidence of cough reflex (8.6%) than the lidocaine gel (51.4%) and placebo groups (65.7%). **Conclusion:** EMLA cream efficiently regulates hemodynamic responses and inhibits the cough reflex during endotracheal intubation and extubation. These results indicate that EMLA cream can improve patient safety and comfort, making it an important complement to anesthetic regimens. Additional multicenter studies with larger sample sizes are necessary to corroborate these findings.

**KEYWORDS** lidocaine, prilocaine cream, emla cream, hemodynamic responses, cough reflex

## 1. INTRODUCTION

During general anesthesia, endotracheal intubation is frequently performed, especially on elderly patients having upper abdominal surgery. However, it causes major physiological, pharmacokinetic, and dynamic changes that can raise the risk of cardiovascular and cerebrovascular problems. These changes include cough reflexes and temporary hemodynamic abnormalities during the intubation and extubation phases [1].

These hemodynamic responses can persist for up to 10 minutes and start at 30 seconds after intubation [2].

Hemodynamic reactions such as elevations in heart rate, blood pressure, myocardial contractility, and systemic vascular resistance are linked to both tracheal intubation and extubation. This is brought on by elevated sympathoadrenal activity, which in turn causes a rise in plasma catecholamine concentration. The majority of individuals may tolerate these reactions with little clinical repercussion [3]. consequently, attenuating these responses is crucial to enhance patient safety and optimize perioperative outcomes.

Numerous pharmaceutical approaches have been investigated to lessen these negative consequences. To reduce the sympathetic response, intravenous medications like beta-blockers, calcium channel blockers, opioids, and vasodilators have been employed [4]. Furthermore, topical anesthetics have drawn interest due to their capacity to locally inhibit sensory nerve transmission without having a major systemic impact [5].

The topical anesthetic Eutectic Mixture of Local Anesthetics (EMLA) cream, which contains prilocaine and lidocaine, is well known for its ability to provide cutaneous analgesia. Its use in airway management offers a fresh method for lowering cough reflexes and hemodynamic reactions during endotracheal intubation and extubation. EMLA cream may reduce afferent neural transmission by anesthetizing the oropharyngeal and laryngeal mucosal surfaces, which would lessen reflex

sympathetic stimulation [5].

Recent studies has started to look into how helpful EMLA cream is in this situation. According to preliminary results, applying EMLA cream before to surgery may result in more stable hemodynamic parameters during airway manipulation and less coughing while waking up from anesthesia [6]. Patients who are at risk for cardiovascular problems or who want to have as little hemodynamic disruption as possible may benefit most from these effects.

Even with these encouraging results, it is still not common practice to utilize EMLA cream to regulate cough reflexes and hemodynamic reactions during endotracheal procedures. To provide standardized procedures for dosage, administration time, and possible adverse effects, more study is required. Anaesthesiologists may be able to improve patient care during surgery by evaluating the effectiveness of EMLA cream [7].

The purpose of this study is to evaluate how applying EMLA cream affects hemodynamic reactions and the cough reflex related to endotracheal intubation and extubation in surgical patients. In order to improve perioperative care and patient outcomes, we want to provide evidence that can encourage the integration of this non-invasive technique into standard anesthetic practice by examining its efficacy and safety.

## 2. METHODS

Cross-sectional study involving 105 surgical patients. After obtaining the approval of Karbala, health directorate committee granted the study its blessing in terms of ethics (MOH). The study was conducted in Imam Al-Hassan hospital in Karbala/Iraq from the beginning of March 2024 to the end of August 2024.

Evaluate EMLA cream's effect on MAP, HR, and cough reflex post-intubation/extubation, comparing efficacy with lidocaine gel and placebo in minimizing hemodynamic fluctuations.

### *2.1 Inclusion criteria*

· Age > 20 years
· All types of abdominal surgeries

### *2.2 Exclusion criteria*

1) Cesarean Suction
2) Lack of medical documents

### *2.3 Data collection, tool, and procedure*

The data was collected using a structured Formula. Through each week during the study period. Any patient admitted through these days who fitted the inclusion criteria and accepted to participate in the study was included. The Formula consisted of six parts cleared in result chapter.

### *2.4 Statistical analysis*

Data analyzed using SPSS v27: descriptive statistics (frequency, mean±SD); parametric tests (Pearson, ANOVA, t-tests) or non-parametric (Spearman, Mann-Whitney, Kruskal-Wallis) and regression.

## 3. RESULT

**TABLE 1.**

| Demographic Characteristics | Subgroup | Descriptive | |
|---|---|---|---|
| | | f. | %. |
| Age group | Early adulthood (20-39 y) | 58 | 55.2 |
| | Middle adulthood (40-59 y) | 32 | 30.5 |
| | Old age (>60 y) | 15 | 14.3 |
| | Total | 105 | 100.0 |
| Gender | Male | 48 | 45.7 |
| | Female | 57 | 54.3 |
| | Total | 105 | 100.0 |
| Marital status | Married | 88 | 83.8 |
| | Not married | 17 | 16.2 |
| | Total | 105 | 100.0 |
| Smoker | Yes | 39 | 37.1 |
| | No | 66 | 62.9 |
| | Total | 105 | 100.0 |
| Past medical history | None | 58 | 55.2 |
| | HTN&DM OR DM OR HTN | 28 | 26.7 |
| | HTN,DM&Bronchitis or HTN&Bronchitis or Bronchitis | 19 | 18.1 |
| | Total | 105 | 100.0 |
| Type of surgery | Open surgery | 45 | 42.9 |
| | Laparoscope | 60 | 57.1 |
| | Total | 105 | 100.0 |
| Type of topical material | EMLA Cream | 35 | 33.3 |
| | Lidocaine Gel | 35 | 33.3 |
| | Placebo | 35 | 33.3 |
| | Total | 105 | 100.0 |

In Table 1 the results showed that the Majority aged 20–39y (55.2%), female (54.3%), married (83.8%), non-smokers (62.9%), no medical history (55.2%); 57.1% laparoscopy; equal topical groups (33.3% each).

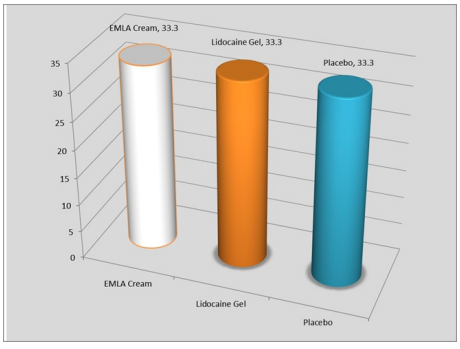


**FIGURE 1. Percentage of the participants according to type of topical material**

In Table 2 the results showed that the EMLA/Placebo: 65.7%/71.4% 20–39y; Lidocaine: 42.9% 40–59y. Female: EMLA (65.7%), Lidocaine (54.3%); male Placebo (57.1%). Majority married, non-smokers. Lidocaine: 42.9% HTN/DM. EMLA: 85.7% laparoscopy; others open.

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**TABLE 2.**

| Demographic Characteristics | Subgroup | EMLA Cream group | | Lidocaine Gel group | | | Placebo group | |
|---|---|---|---|---|---|---|---|---|
| | | f. | %. | f. | %. | | f. | %. |
| Age group | Early adulthood (20-39 y) | 23 | 65.7 | 10 | 28.6 | | 25 | 71.4 |
| | Middle adulthood (40-59 y) | 9 | 25.7 | 15 | 42.9 | | 8 | 22.9 |
| | Old age (>60 y) | 3 | 8.6 | 10 | 28.6 | | 2 | 5.7 |
| | Total | 35 | 100.0 | 35 | 100.0 | | 35 | 100.0 |
| Gender | Male | 12 | 34.3 | 16 | 45.7 | | 20 | 57.1 |
| | Female | 23 | 65.7 | 19 | 54.3 | | 15 | 42.9 |
| | Total | 35 | 100.0 | 35 | 100.0 | | 35 | 100.0 |
| Marital status | Married | 30 | 85.7 | 32 | 91.4 | | 26 | 74.3 |
| | Not married | 5 | 14.3 | 3 | 8.6 | | 9 | 25.7 |
| | Total | 35 | 100.0 | 35 | 100.0 | | 35 | 100.0 |
| Smoker | Yes | 9 | 25.7 | 13 | 37.1 | | 17 | 48.6 |
| | No | 26 | 74.3 | 22 | 62.9 | | 18 | 51.4 |
| | Total | 35 | 100.0 | 35 | 100.0 | | 35 | 100.0 |
| Past medical history | None | 21 | 60.0 | 13 | 37.1 | | 24 | 68.6 |
| | HTN&DM or DM or HTN | 8 | 22.9 | 15 | 42.9 | | 5 | 14.3 |
| | HTN,DM&Bronchitis or HTN&Bronchitis or Bronchitis | 6 | 17.1 | 7 | 20.0 | | 6 | 17.1 |
| | Total | 35 | 100.0 | 35 | 100.0 | | 35 | 100.0 |
| Type of surgery | Open surgery | 5 | 14.3 | 20 | 57.1 | | 20 | 57.1 |
| | Laparoscope | 30 | 85.7 | 15 | 42.9 | | 15 | 42.9 |
| | Total | 35 | 100.0 | 35 | 100.0 | | 35 | 100.0 |

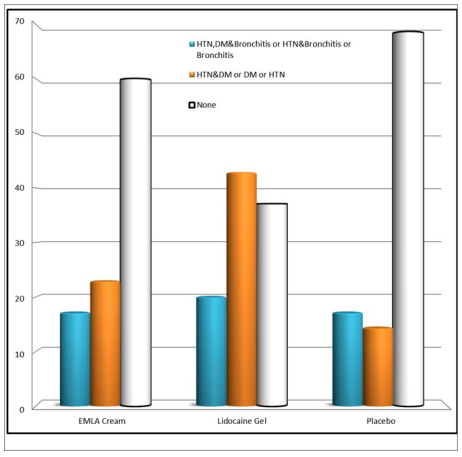


**FIGURE 2. Percentage of the participants past medical history according to type of topical material**

In Table 3 the results showed that the distribution of the patients vital signs at Preoperative, Intraoperative and Postoperative.

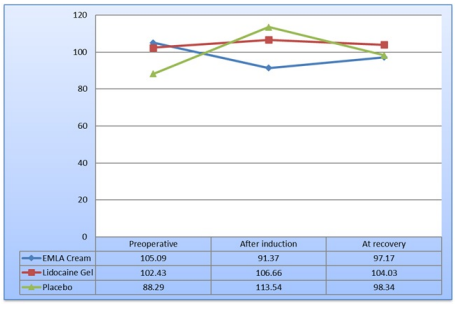


**FIGURE 3. The patients MAP at perioperative for the three groups**

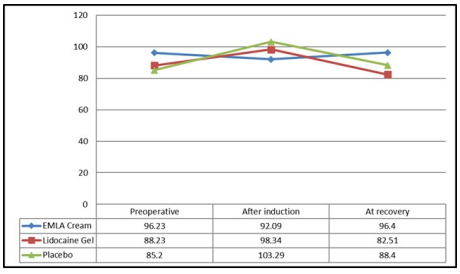


**FIGURE 4. The patients H.R at Preoperative, Intraoperative and Postoperative for the three groups**

In Table 4 the results shown that there were Placebo: MAP ($p<0.001$) and HR ($p<0.001$) showed highly significant induction-recovery differences. EMLA: MAP differed significantly ($p<0.05$).

In table 5 the results showed that the EMLA showed mild cough [0_09] vs. Lidocaine [0_51]/Placebo [0_66]; significant group differences ($p<0.001$).

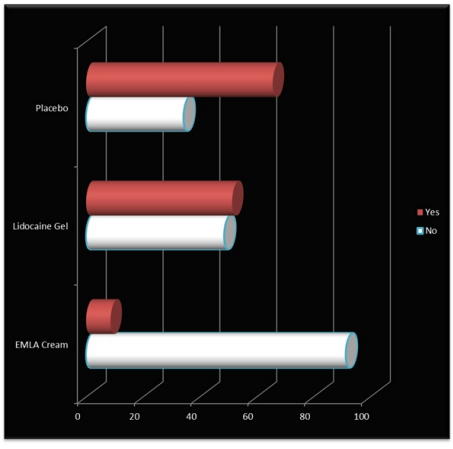


**FIGURE 5. Patients cough reflex level at Postoperative for the three groups**

**TABLE 3.**

| V.S | Groups | | Preoperative (induction) | | Intraoperative (maintenance) | | Postoperative (recovery) | |
|---|---|---|---|---|---|---|---|---|
| MAP | EMLA Cream | Min – Max | 77 | 133 | 67 | 117 | 60 | 127 |
| | | Mean ± SD | 105.09 | 14.178 | 91.37 | 15.241 | 97.17 | 13.796 |
| | Lidocaine Gel | Min – Max | 70 | 167 | 63 | 147 | 69 | 127 |
| | | Mean ± SD | 102.43 | 20.988 | 106.66 | 18.708 | 104.03 | 14.642 |
| | Placebo | Min – Max | 60 | 113 | 83 | 137 | 69 | 142 |
| | | Mean ± SD | 88.29 | 15.356 | 113.54 | 13.574 | 98.34 | 13.841 |
| H.R | EMLA Cream | Min – Max | 67 | 153 | 69 | 142 | 62 | 123 |
| | | Mean ± SD | 96.23 | 17.687 | 92.09 | 14.581 | 96.40 | 16.518 |
| | Lidocaine Gel | Min – Max | 59 | 126 | 65 | 162 | 68 | 133 |
| | | Mean ± SD | 88.23 | 17.220 | 98.34 | 19.383 | 92.51 | 12.519 |
| | Placebo | Min – Max | 53 | 125 | 63 | 155 | 58 | 131 |
| | | Mean ± SD | 85.20 | 18.253 | 103.29 | 23.359 | 88.40 | 17.172 |

**TABLE 4.**

| | | Induction | Intra | Recovery | t | df | P. value | Sig. |
|---|---|---|---|---|---|---|---|---|
| MAP | EMLA Cream | 105.09 | | 97.17 | 3.076 | 34 | .004 | S |
| | | | 91.37 | 97.17 | -2.124- | 34 | .041 | S |
| | Lidocaine Gel | 102.43 | | 104.03 | -.517- | 34 | .608 | NS |
| | | | 106.66 | 104.03 | .906 | 34 | .371 | NS |
| | Placebo | 88.29 | | 98.34 | -4.275- | 34 | .000 | HS |
| | | | 113.54 | 98.34 | 6.024 | 34 | .000 | HS |
| H.R | EMLA Cream | 96.23 | | 96.4 | -.047- | 34 | .963 | NS |
| | | | 92.09 | 96.4 | -1.445- | 34 | .158 | NS |
| | Lidocaine Gel | 88.23 | | 82.51 | -1.390- | 34 | .173 | NS |
| | | | 98.34 | 82.51 | 1.969 | 34 | .057 | NS |
| | Placebo | 85.2 | | 88.4 | -1.493- | 34 | .145 | NS |
| | | | 103.29 | 88.4 | 5.128 | 34 | .000 | HS |

**TABLE 5.**

| | Descriptive | | EMLA Cream | | Lidocaine Gel | | Placebo | | F | P. value |
|---|---|---|---|---|---|---|---|---|---|---|
| Cough Reflex | f. _ %. | No | 32 | 91.4 | 17 | 48.6 | 12 | 34.3 | 16.298 | .000 |
| | | Yes | 3 | 8.6 | 18 | 51.4 | 23 | 65.7 | | |
| | | Total | 35 | 100.0 | 35 | 100.0 | 35 | 100.0 | | |
| | Min – Max | | 0 | 1 | 0 | 1 | 0 | 1 | | |
| | Mean ± SD | | .09 | .284 | .51 | .507 | .66 | .482 | | |

**TABLE 6.**

| Demographic Characteristics | Subgroup | EMLA Cream group | | | | Lidocaine Gel group | | | | Placebo group | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M. | S.D. | Analysis | Sig. | M. | S.D. | Analysis | Sig. | M. | S.D. | Analysis | Sig. |
| Age group | Early adulthood (20-39 y) | .04 | .209 | F=1.470 | .245 | .50 | .527 | F=.017 | .983 | .68 | .476 | F=.959 | .394 |
| | Middle adulthood (40-59 y) | .22 | .441 | | | .53 | .516 | | | .50 | .535 | | |
| | Old age (>60 y) | .00 | .000 | | | .50 | .527 | | | 1.00 | .000 | | |
| | Total | .09 | .284 | | | .51 | .507 | | | .66 | .482 | | |
| Gender | Male | .08 | .289 | t=-.035- | .972 | .44 | .512 | t=-.818- | .419 | .65 | .489 | t=-.100- | .921 |
| | Female | .09 | .288 | | | .58 | .507 | | | .67 | .488 | | |
| | Total | .09 | .284 | | | .51 | .507 | | | .66 | .482 | | |
| Smoker | Yes | .22 | .441 | t=1.720 | .095 | .54 | .519 | t=.214 | .832 | .76 | .437 | t=1.297 | .204 |
| | No | .04 | .196 | | | .50 | .512 | | | .56 | .511 | | |
| | Total | .09 | .284 | | | .51 | .507 | | | .66 | .482 | | |
| Past medical history | None | .05 | .218 | t=1.895 | .167 | .54 | .519 | t=.937 | .402 | .67 | .482 | t=1.127 | .336 |
| | HTN&DM or DM or HTN | .25 | .463 | | | .40 | .507 | | | .40 | .548 | | |
| | HTN,DM&Bronchitis or HTN&Bronchitis or Bronchitis | .00 | .000 | | | .71 | .488 | | | .83 | .408 | | |
| | Total | .09 | .284 | | | .51 | .507 | | | .66 | .482 | | |
| Type of surgery | Open surgery | .00 | .000 | F=-.724- | .474 | .60 | .503 | F=1.161 | .254 | .70 | .470 | F=.602 | .551 |
| | Laparoscope | .10 | .305 | | | .40 | .507 | | | .60 | .507 | | |

## 4. DISCUSSION

The study revealed that EMLA cream significantly reduced MAP during the intraoperative and postoperative periods compared to the placebo group. The mean MAP for the EMLA group was lower compared to the placebo group during induction and recovery (Table 4). This suggests that EMLA cream is effective in stabilizing MAP during surgical procedures, which is crucial for patient safety and reducing the risk of cardiovascular events [8].

Similarly, the heart rate was better controlled in the EMLA group compared to the placebo group. The mean HR for the EMLA group, significantly different to the placebo group (Table 4). This indicates that EMLA cream helps in maintaining a stable heart rate, reducing the stress on the cardiovascular system during surgery [9].

The incidence of cough reflex postoperatively was significantly lower in the EMLA group compared to the lidocaine gel and placebo groups. Only a few of patients in the EMLA group experienced a cough reflex, compared to the lidocaine gel group and the placebo group (Table 5). This demonstrates

the superior efficacy of EMLA cream in suppressing the cough reflex, which is beneficial in reducing postoperative complications and improving patient comfort [7].

The distribution of socio-demographic and clinical data showed no significant differences between the groups, indicating that the observed effects were likely due to the topical treatments rather than demographic or clinical variations (Table 1 and Table 2). This strengthens the validity of the study findings and supports the generalizability of the results to a broader patient population [10].

## 5. CONCLUSION

The application of EMLA cream is effective in controlling hemodynamic responses and suppressing the cough reflex during endotracheal intubation and extubation in surgical settings. These findings suggest that EMLA cream can be a valuable addition to anesthesia protocols, enhancing patient safety and comfort.

## REFERENCES


[1] Lv, Linsheng, et al. "Effectiveness of lidocaine/prilocaine cream on cardiovascular reactions from endotracheal intubation and cough events during recovery period of older patients under general anesthesia: prospective, randomized placebo-controlled study." *BMC Geriatrics* 20.1 (2020): 157.

[2] Pradhan, Amit, et al. "Efficacy of two different doses of nebulized dexmedetomidine for attenuation of hemodynamic response to laryngoscopy and intubation: A randomized controlled trial." *Indian Journal of Clinical Anaesthesia* 12.1 (2025):28–35

[3] Agarwal, Meenal, and Anuradha Malliwal. "Effect of dexmedetomidine on hemodynamic responses during tracheal extubation." *Indian Journal of Clinical Anaesthesia* 6.1 (2019): 23-29.

[4] Babamohamadi, Hassan, et al. "Comparison of the effect of EMLA™ cream and the Valsalva maneuver on pain severity during vascular needle insertion in hemodialysis patients: a controlled, randomized, clinical trial." *Evidence-Based Complementary and Alternative Medicine* 2022.1 (2022): 8383021.

[5] Kumar, Mritunjay, Rajiv Chawla, and Manish Goyal. "Topical anesthesia." *Journal of Anaesthesiology Clinical Pharmacology* 31.4 (2015): 450-456.

[6] Yu, Hai, et al. "EMLA® cream coated on endotracheal tube with or without epidural lidocaine reduces isoflurane requirement during general anesthesia." *Frontiers of Medicine* 6.3 (2012): 302-306.

[7] Sohmer, Benjamin, et al. "EMLA cream is an effective topical anesthetic for bronchoscopy." *Canadian Respiratory Journal* 11.8 (2004): 587-588.

[8] Meng, You-Fan, et al. "Local airway anesthesia attenuates hemodynamic responses to intubation and extubation in hypertensive surgical patients." *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research 20* (2014): 1518.

[9] Rangatchew, Filip, et al. "EMLA cream in burns: A systematic review of safety, analgesic efficacy, and effects on burn pathophysiology." *Journal of Plastic, Reconstructive & Aesthetic Surgery 95* (2024): 386-401.

[10] Rigatelli, Gianluca, et al. "Topical anaesthesia before transradial approach for supraoartic vessels angiography and stenting in the elderly: a feasible alternative." *Journal of Geriatric Cardiology: JGC* 14.10 (2017): 644.