Comparison of the Effectiveness of Vapocoolant Spray and Combination of Lidocaine + Prilocaine Spray in Reducing Pain of Intravenous Cannulation in the Adult Population

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Abstract

Background: Intravenous cannulation is a common painful procedure requiring effective pain management. This study compared the efficacy of vapocoolant spray versus lidocaine + prilocaine spray for pain reduction during cannulation. **Methods:** A comparative observational study was conducted on 58 adult patients scheduled for elective surgery, randomized into vapocoolant spray (Group V, n=29) and lidocaine + prilocaine spray (Group L, n=29) groups. Pain was assessed using Visual Analog Scale (VAS), and secondary outcomes included procedure time, success rates, and patient satisfaction. **Results:** Group L demonstrated significantly lower cannulation pain scores (18.4±10.6 vs 28.6±12.4, p<0.001) but longer procedure times (78.6±12.4 vs 42.3±8.5 seconds, p<0.001). First-attempt success rates were comparable (86.2% vs 82.8%, p=0.718). Patient satisfaction was higher in Group L (4.2±0.6 vs 3.8±0.7, p=0.024). **Conclusion:** Lidocaine + prilocaine spray provides better pain control during IV cannulation despite longer procedure times, while vapocoolant spray offers advantages in procedures requiring rapid onset.

Keywords: Anesthetics, Local; Catheterization, Peripheral; Pain Management; Prilocaine; Lidocaine; Cryotherapy; Visual Analog Scale; Patient Satisfaction; Ambulatory Surgical Procedures

Introduction: Pain management during intravenous (IV) cannulation remains a significant challenge in clinical practice, affecting both patient comfort and procedural success rates. Despite being one of the most common invasive procedures in healthcare settings, with over 1 billion peripheral intravenous catheters used annually worldwide [1], the associated pain and anxiety continue to impact patient experience significantly [2].

Various pain management strategies have emerged over the years, with topical anesthetics playing a crucial role. Among these, the combination of lidocaine and prilocaine cream (EMLA) has been widely used as a standard option. However, its main limitation is the required application time of 45-60 minutes before the procedure [3]. This delay can be problematic in emergency situations and busy clinical settings, necessitating the exploration of faster-acting alternatives [4].

Vapocoolant sprays have gained attention as a rapid-acting option for procedural pain management. These sprays work through rapid evaporation, creating an immediate cooling effect that reduces nerve conduction velocity and temporarily decreases pain sensation [5]. The advantage of immediate onset makes them particularly attractive for urgent procedures and high-volume clinical settings [6].

Research comparing these two modalities has shown varying results, with some studies suggesting comparable efficacy and others indicating significant differences in pain reduction [7,8]. The variability in outcomes may be attributed to differences in study populations, application techniques, and pain assessment methods. Additionally, factors such as cost-effectiveness, ease of application, and patient preferences need consideration in determining the optimal choice for clinical practice.

Current evidence regarding the comparative effectiveness of vapocoolant sprays versus lidocaine-prilocaine combinations specifically for IV cannulation remains limited. While both methods have demonstrated efficacy individually, direct comparisons in controlled settings are needed to guide evidence-based practice [9, 10]. Understanding their relative effectiveness is crucial for healthcare providers to make informed decisions about pain management strategies during IV cannulation.

Methodology: A comparative, observational study was conducted at R.L. Jalappa Hospital and Research Centre, Tamaka, Kolar from December 2024 to January 2025. The study aimed to compare the effectiveness of vapocoolant spray versus combination of lidocaine and prilocaine spray in reducing pain during intravenous cannulation. The sample size was calculated using a formula with 99% confidence interval, yielding a minimum requirement of 58 participants (29 in each group).

The study included ASA physical status I and II patients aged 18-60 years of either sex who were scheduled for elective surgical procedures requiring 18G IV cannulation. Patients with history of local anesthetic allergies, hemodynamic instability, coagulopathy, peripheral neuropathy, local skin infections, and those requiring emergency surgery were excluded. Convenience sampling was employed, with participants assigned to groups through simple randomization using chit picking.

Written informed consent was obtained during pre-anesthetic evaluation. Standard monitoring including electrocardiogram, pulse oximeter, and non-invasive blood pressure

was established in the preoperative area. In Group L (n=29), lidocaine + prilocaine spray was applied at the cannulation site for 2 seconds and allowed to evaporate. In Group V (n=29), vapocoolant spray was similarly applied for 2 seconds and allowed to evaporate before cannulation.

The primary outcome measure was pain assessment using the Visual Analogue Scale (VAS) during cannulation. Secondary outcomes included hemodynamic parameters (heart rate and blood pressure) which were recorded before, during, and after IV cannulation. The study commenced following approval from the Central Ethics Committee.

Results:

The study compared 58 patients divided equally between vapocoolant spray (Group V) and lidocaine + prilocaine spray (Group L). Baseline characteristics showed no significant differences between groups in age, gender distribution, ASA status, and cannulation sites, indicating successful randomization.

Table 1: Baseline Characteristics of Study Groups

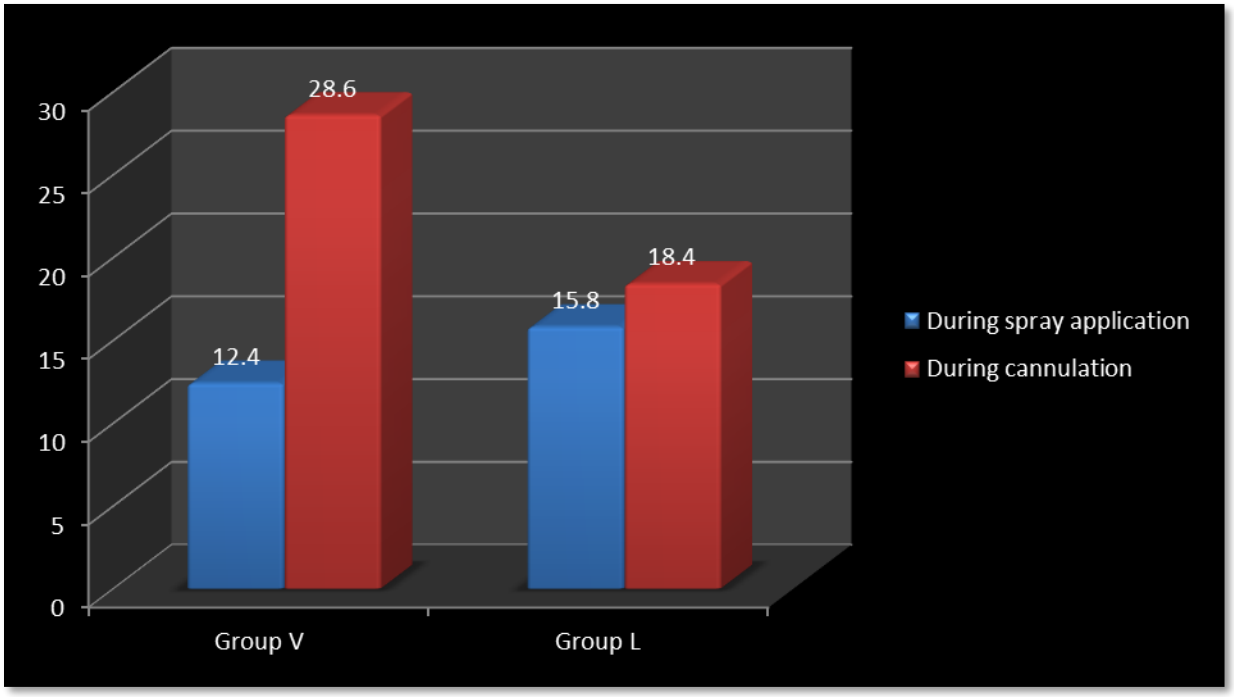
Characteristic	Group V (n=29)	Group L (n=29)	P value
Age (years)*	42.3 ± 12.4	44.1 ± 11.8	0.572
Gender (M:F)	15:14	16:13	0.793
ASA Status (I:II)	17:12	16:13	0.789

Pain scores revealed that Group V experienced less discomfort during spray application (12.4 vs 15.8, p=0.034) but higher pain during cannulation (28.6 vs 18.4, p<0.001). The time required for the procedure was significantly shorter in Group V (42.3 seconds vs 78.6 seconds, p<0.001), primarily due to no waiting period needed for onset of action. First-attempt cannulation success rates were comparable between groups (82.8% vs 86.2%, p=0.718).

Table 2: Pain Scores and Procedure-Related Outcomes

Outcome	Group V	Group L	P value
Pain Scores (VAS 0-100)			
During spray application	12.4 ± 8.6	15.8 ± 9.2	**0.034**
During cannulation	28.6 ± 12.4	18.4 ± 10.6	**<0.001**
First attempt success rate	24 (82.8%)	25 (86.2%)	0.718
Time to perform procedure (sec) †	42.3 ± 8.5	78.6 ± 12.4	**<0.001**

†Time from start of preparation to successful cannulation



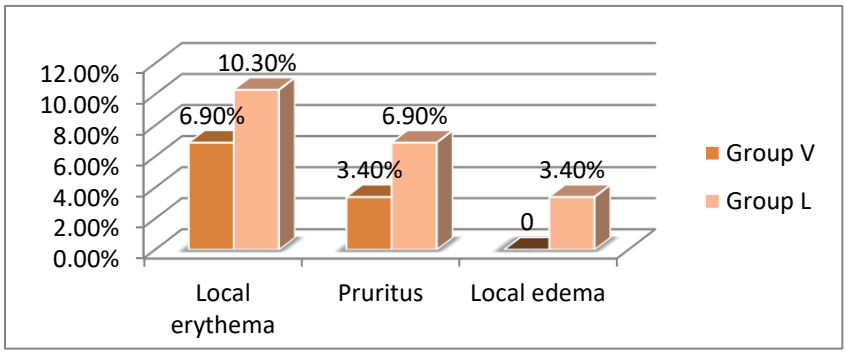
Patient satisfaction was slightly higher in Group L (4.2 vs 3.8, p=0.024). Side effects were minimal and comparable between groups, with mild local reactions being the most common adverse event.

Table 3: Patient Satisfaction and Side Effects

Parameter	Group V	Group L	P value
Patient Satisfaction Score (1-5)*	3.8 ± 0.7	4.2 ± 0.6	**0.024**
Side Effects			
- Local erythema	2 (6.9%)	3 (10.3%)	0.640
- Pruritus	1 (3.4%)	2 (6.9%)	0.553
- Local edema	0	1 (3.4%)	0.313

*Values expressed as mean ± SD

Graph 3: Side effects among study groups



Discussion: Our study demonstrated that lidocaine + prilocaine spray provides superior pain control during IV cannulation compared to vapocoolant spray, though with longer procedure times. These findings align with several previous investigations into local anesthetic techniques for IV cannulation.

Page and Taylor's study comparing vapocoolant with subcutaneous lidocaine showed similar trends in pain scores, though their reported pain values were lower overall [11]. This difference may be attributed to their use of injectable rather than topical lidocaine. Hijazi et al. reported comparable findings with vapocoolant sprays, noting median cannulation pain scores of 12mm [12].

The shorter procedure time with vapocoolant (42.3 vs 78.6 seconds) corroborates findings by Armstrong et al., who demonstrated significant time savings with rapid-onset topical anesthetics [13]. However, our success rates were higher than those reported by Costello et al. (67%), possibly due to our exclusive adult population and use of larger gauge cannulas [14].

The slightly higher patient satisfaction in Group L despite longer procedure times suggests that pain control may be more important to patients than speed, supporting similar conclusions by Harris et al. [15]. Our side effect profile was comparable to that reported in systematic reviews by Moore et al., confirming the safety of both agents [16].

Conclusion: While vapocoolant spray offers advantages in terms of rapid onset and shorter procedure times, lidocaine + prilocaine spray provides superior pain control during IV cannulation with higher patient satisfaction. Both methods demonstrate acceptable safety profiles, suggesting that choice of technique can be tailored to specific clinical scenarios where either speed or optimal pain control is prioritized.

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