COMPARISON OF XYLOCAINE ADDITION TO PROPOFOL VS LOCAL TAPPING FOR ALLEVIATING INJECTION PAIN

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ABSTRACT

OBJECTIVES

To evaluate and compare the efficacy of xylocaine–propofol admixture and local tapping in reducing the incidence and severity of propofol injection pain.

METHODOLOGY

This quasi-experimental comparative study was conducted at Shalamar Hospital, Lahore, from August 2025 to December 2025, involving 120 adult patients undergoing elective surgery under general anesthesia. Group A received propofol mixed with 0.5 ml of 2% xylocaine, while Group B received standardized local tapping for five seconds before propofol administration. Pain severity was assessed using a four-point verbal rating scale after the first 5 ml of propofol.

RESULTS

Pain incidence and severity were significantly lower in the xylocaine group. No pain was reported by 63.3% of patients in Group A compared to 20.0% in Group B, while severe pain occurred in only 1.7% versus 16.7%, respectively ($p < 0.001$). The mean pain score was significantly lower in Group A (0.50 ± 0.73) than in Group B (1.47 ± 1.04) ($p < 0.001$). Hemodynamic changes were also smaller in the xylocaine group, with heart rate and systolic blood pressure increasing by +2.7 bpm and +2.1 mmHg, compared to +6.7 bpm and +6.2 mmHg in the tapping group ($p < 0.05$). Adverse events were minimal, with only one mild irritation case in Group A. Patient satisfaction was higher in Group A, with 66.7% reporting being very satisfied compared to 30.0% in Group B.

CONCLUSION

It is concluded that xylocaine admixture is significantly more effective than local tapping in reducing propofol injection pain, stabilizing hemodynamic responses, and improving patient satisfaction. Local tapping may offer partial benefit but should not replace xylocaine as the preferred technique for minimizing discomfort during propofol administration.

KEYWORDS: *Propofol Injection Pain, Xylocaine Admixture, Pain Reduction, Anesthesia Induction, General Anesthesia, Patient Satisfaction*

INTRODUCTION

Propofol remains one of the most widely used intravenous induction agents in modern anesthesia because of its rapid onset, short recovery profile, antiemetic properties, and predictable pharmacokinetics.[1] Pain is one of the most commonly reported adverse experiences during the induction of propofol anesthesia, ranging from 9.8% to 28.4% in adults despite its popularity and its perception as a safe anesthetic agent.[2,3] The pain experienced during induction has a significant impact on the ability to enjoy a normal life.[4] The pain impacts satisfaction, perceptions of anesthesia quality, and can incite several clinically noteworthy behaviors over the induction period, such as increasing patient anxiety, sympathetic stress responses, and movement.[5] This is particularly the case during high-stress situations in emergency surgeries (or pediatrics) where agitation secondary to injection pain can create chaos in an otherwise manageable scenario. This has led most practitioners to seek the simplest, most effective, and safest techniques for alleviating discomfort (without adding too much complexity to the induction sequence) to the optimal level of discomfort.[6] The complex mechanisms responsible for propofol pain involve not only pathways associated with pain but also those associated with injury or damage. The lipid emulsion in propofol, for example, causes direct injury to the venous endothelium, resulting in pain, but also activates the kinin cascade, which, as a secondary cascade, can lead to a burning pain. Adding to the complexity of responses to propofol and the pathways involved is the patient and the adverse characteristics they bring to propofol anesthesia.[7] The pathways, along with the adverse characteristics of patients to the propofol, all factor into why no single technique or intervention has helped end the significant debate over the optimal techniques of propofol injection. For quite some time, adding lidocaine

to a mixture has been considered the gold standard.[8] The addition of xylocaine to propofol is believed to reduce endothelial irritation, reduce nerve conduction, and control the release of inflammatory mediators. Numerous sources have shown the location of the lidocaine as a rational pharmacological option, as there is a decrease in the frequency as well as the severity of the pain.[9] More questionable, however, is the stability of the propofol–lidocaine mixture, the best concentration of the mixture, and the variations of the propofol in question. Also, lidocaine is effective. However, some practitioners wish to avoid modification of the drug mixtures, and lidocaine is the result of that.[10] In contrast, local tapping is the option modern anesthetic workflows prefer: a fully non-drug technique based on the gate control theory of pain. Propofol, chemically known as 2,6-diisopropylphenol, is lipid-rich and thus cannot dissolve in water. Propofol requires a lipid-based solution because its oily properties inhibit efficient entry into the bloodstream. The precursor solution is made from soybean oil, egg lecithin, and glycerol, which gives it a white, opaque appearance. Propofol has isopropyl side chains that make it hydrophobic, resulting in a thick, difficult-to-mix solution with water.[11] Affecting numerous other patients, those who receive propofol injections emerge from the procedure with immense post-operative pain. The infusion emulsion can result in infection and, if taken for a long duration, can adversely affect blood lipid levels.[12] There are new studies in which propofol is dissolved in cyclodextrin liquids, microemulsions, and water-soluble drug release systems, rather than the traditional lipid emulsion.[13] Injection pain in propofol has been a problem since the first clinical trial in 1977, and numerous methods including mixing lidocaine with propofol in the same syringe, pre-treatment with lidocaine or procaine, cooling, warming, or diluting the propofol solution, injecting propofol into a large vein, and the prior injection of ondansetron, ketamine, opioids, magnesium sulfate, ketorolac or tramadol have been applied.[14] Studies on metoclopramide pre-treatment and propofol premixed with lidocaine as two effective and safe methods have also been documented.[15]

METHODOLOGY

This quasi-experimental comparative study was conducted at Shalamar Hospital, Lahore, from August 2025 to December 2025, involving 120 adult patients undergoing elective surgery under general anesthesia. Ethical approval was obtained before the start of the study. Written informed consent was secured from all patients after explaining the aim, procedure, and potential risks of the interventions. The sample size was calculated using the WHO Sample Size Calculator version 2.0, which is commonly utilized in clinical research across Pakistan. Using the formula for a single population proportion,

$$n = Z^2 \times p(1-p) / d^2$$

With a 95% confidence level (Z = 1.96), expected proportion p = 0.50, and margin of error d = 0.10, the minimum required sample size was calculated to be 96. To strengthen the study's power and compensate for potential dropouts or incomplete responses, the final sample size was increased to 120 participants. Participants were selected through a non-probability consecutive sampling method. Adults aged 18-65 years, ASA physical status I or II, Elective surgery requiring propofol induction, and an intravenous cannula placed on the dorsum of the hand were included. The known allergy to lidocaine or propofol, chronic pain disorders, communication barriers, analgesic use within 24 hours, and difficult venous access or need for alternative induction agents were excluded. Participants were divided into two predefined groups based on the technique applied by the attending anesthesiologist. Group A received propofol premixed with 0.5 ml of 2% xylocaine immediately before injection, while Group B received standardized local tapping for approximately five seconds at the injection site immediately before propofol administration. This allocation method reflected common clinical practice variations while maintaining intervention consistency within each group. All patients had an 18-G or 20-G intravenous cannula inserted on the dorsum of the hand. Propofol was administered at a standardized rate of 1 ml/sec in both groups to maintain uniform pain-eliciting conditions. After the initial 5 ml of propofol, each patient was asked to describe the level of injection pain experienced. No sedatives or analgesics affecting pain perception were given before induction to avoid confounding the results. Pain was assessed using a validated four-point verbal rating scale, ranging from 0 (no pain) to 3 (severe pain). The scale was chosen for its simplicity, reliability, and suitability for rapid assessment during anesthesia induction. Each patient's response was recorded immediately to ensure accuracy. Heart rate and systolic blood pressure were recorded just before and immediately after propofol administration to observe any autonomic changes potentially associated with pain perception. These parameters helped identify whether injection pain triggered measurable physiological stress responses. The primary outcome of the study was the severity of pain during propofol injection as rated by the patient. Secondary outcomes included the overall incidence of pain, reported discomfort, and any adverse reactions related to either lidocaine admixture or the tapping technique. These outcomes allowed a comprehensive comparison of both interventions. All collected data were entered and analyzed using SPSS version 26.0. Categorical variables, such as pain severity

and pain incidence, were evaluated using the chi-square test, while continuous variables, including changes in heart rate and blood pressure, were analyzed using an independent-samples t-test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Data were collected from 120 patients; baseline physiological parameters demonstrated close similarity between the interventions.

Table 1: Baseline Demographic and Clinical Characteristics of Patients (N = 120)

Variable	Group A (Xylocaine + Propofol) (n = 60)	Group B (Local Tapping) (n = 60)
Age (years), mean ± SD	37.8 ± 12.4	38.5 ± 11.9
Gender (Male), n (%)	32 (53.3%)	31 (51.6%)
Baseline Heart Rate (bpm), mean ± SD	82.4 ± 9.6	83.1 ± 10.1
Baseline Systolic BP (mmHg), mean ± SD	123.5 ± 11.4	124.2 ± 10.9

Table 2: Comparison of Propofol Injection Pain Severity Between Groups

Pain Severity	Group A (Xylocaine + Propofol) (n = 60)	Group B (Local Tapping) (n = 60)	p-value
No Pain	38 (63.3%)	12 (20.0%)	<0.001
Mild Pain	15 (25.0%)	18 (30.0%)	
Moderate Pain	6 (10.0%)	20 (33.3%)	
Severe Pain	1 (1.7%)	10 (16.7%)	
Mean Pain Score (0-3 scale)	0.50 ± 0.73	1.47 ± 1.04	<0.001
Patients with Any Pain (Mild+Moderate+Servere)	22 (36.7%)	48 (80.0%)	<0.001
Heart Rate Change (bpm)	+2.7 ± 4.1	+6.7 ± 5.3	0.002
Systolic BP Change (mmHg)	+2.1 ± 3.9	+6.2 ± 5.8	0.001

Table 3: Hemodynamic Changes Before and After Propofol Injection

Parameter	Group A Pre-Injection	Group A Post-Injection	Group B Pre-Injection	Group B Post-Injection	p-value
Heart Rate (bpm), mean ± SD	82.4 ± 9.6	85.1 ± 10.3	83.1 ± 10.1	89.8 ± 11.5	0.014
Systolic BP (mmHg), mean ± SD	123.5 ± 11.4	125.6 ± 12.1	124.2 ± 10.9	130.4 ± 13.6	0.021

*Independent sample t-test comparing the change between groups.

Table 4: Adverse Events and Complications Observed After Interventions (N = 120)

Adverse Event / Complication	Group A (Xylocaine + Propofol (n = 60)	Group B (Local Tapping) (n=60)	p-value
No Adverse Event	59 (98.3%)	60 (100.0%)	0.315
Local Injection -Site Irritation	1 (1.7%)	0 (0.0%)	
Allergic Reaction	0 (0.0%)	0 (0.0%)	
Hematoma / Bruising	0 (0.0%)	0 (0.0%)	
Arrhythmia / Significant Bradycardia	0 (0.0%)	0 (0.0%)	
Serious Adverse Event	0 (0.0%)	0 (0.0%)	

*Independent sample t-test comparing the change between groups.

Table 5: Patient Satisfaction Related to Injection Comfort and Induction Experience

Satisfaction Category	Group A (Xylocaine+ Propofol) (n = 60)	Group B (Local Tapping) (n=60)	p-value
Very Satisfied	40 (66.7%)	18 (30.0%)	<0.001
Satisfied	15 (25.0%)	20 (33.3%)	0.324
Neutral	4 (6.7%)	12 (20.0%)	0.034
Dissatisfied	1 (1.6%)	8 (13.3%)	0.017
Very Dissatisfied	0 (0.0%)	2 (3.3%)	0.151

DISCUSSION

This study compared the effectiveness of adding xylocaine to propofol versus using local tapping at the injection site to alleviate propofol injection pain. The findings clearly demonstrate that xylocaine admixture significantly outperforms local tapping in reducing both the incidence and severity of injection pain. These results align with the well-established pharmacological rationale that lidocaine stabilizes neuronal membranes, reduces venous irritation, and attenuates activation of pain pathways triggered by propofol's lipid emulsion formulation. In contrast, local tapping, although simple and non-pharmacological, produced only partial and inconsistent relief. The markedly higher proportion of patients experiencing no pain in the xylocaine group (63.3%) compared with the tapping group (20.0%) reinforces the superiority of pharmacological modulation over sensory distraction techniques. The mean pain score difference observed between the two groups (0.50 vs. 1.47) further supports this conclusion. These findings are consistent with previous studies reporting that lidocaine admixture significantly lowers the pain associated with propofol induction. Many regional and international studies report lidocaine-induced reductions of 60-70% in incidence, closely

matching the pattern observed in this study. The mechanism of action is believed to involve decreased endothelial irritation, blunting of nociceptive impulses, and inhibition of the kallikrein-kinin cascade, which is implicated in propofol-associated venous pain.[16] Local tapping may help reduce pain by activating A-beta fibers, consistent with the Gate control theory of pain. Activation of these large-diameter mechanoreceptive fibers can inhibit the transmission of nociceptive signals carried by type C fibers in the spinal dorsal horn, thereby reducing pain perception.[17] However, the variable effect this method had in our study indicates that mere sensory distraction is insufficient to alleviate the chemical discomfort during propofol administration. This is further supported by the tapping group's more frequent reports of moderate and severe pain. The present study suggests that, while tapping is promoted as a low-resource alternative, in cases where the comfort of the propofol injection is a top priority, tapping should not be the primary method. The study's hemodynamic results also support the presence of clinically significant differences between the interventions.[18] Patients who received xylocaine injection showed slight changes in heart rate and systolic blood pressure after propofol injection, indicating that nociceptive pain stimulation was limited and that the induction was smoother. On the other hand, the tapping group showed significantly greater increases in heart rate and systolic pressure, consistent with activation of the sympathetic nervous system by pain.[19] These results provide objective verification of the more common subjective patient outcomes and underscore the need to alleviate pain during anesthesia induction. This need is even more pronounced in vulnerable patient populations, where fluctuating hemodynamics could lead to dangerous outcomes. Both interventions also have positive safety profiles. In the xylocaine group, only one person showed mild, transient irritation at the injection site, and none reported any adverse reaction of significant concern.[20] This supports prior studies indicating that the combination of lidocaine and propofol in small quantities is usually well tolerated. The absence of issues in either group supports the use of the described approaches in anesthesia. In the xylocaine group, the rates of very satisfied patients were double that of the tapping-only group.[21] An even lower proportion of patients in the xylocaine cohort were dissatisfied with the propofol injection, indicating that pain at this step is a common negative aspect that detracts from overall anesthesia satisfaction. This study confirms the pain-control-satisfaction correlation previously demonstrated. The negative experience patients report during propofol injection is a common one, and the study also demonstrated strong ties between pain control and overall satisfaction with the anesthetic experience.[22]

LIMITATIONS

This study has several limitations that should be acknowledged. The study was conducted at a single center, which may limit the generalizability of the findings to other institutions with different patient populations, clinical workflows, or anesthesia practices. Pain reporting relied on a verbal rating scale, which is inherently subjective and may be influenced by individual pain thresholds, anxiety levels, or communication styles. Only immediate pain responses and short-term hemodynamic changes were assessed; longer-term outcomes such as delayed discomfort or post-injection complications were not evaluated. Finally, the interventions were performed by different anesthesiologists, which, despite standardized technique instructions, may introduce operator-dependent variability.

CONCLUSIONS

It is concluded that the addition of xylocaine to propofol is significantly more effective than local tapping in alleviating propofol injection pain. Patients who received the xylocaine-propofol admixture experienced lower pain intensity, fewer hemodynamic changes, and greater satisfaction than those managed with local tapping alone. Both techniques were safe; however, local tapping provided only limited, inconsistent relief, whereas lidocaine offered a more reliable, clinically meaningful reduction in discomfort. Therefore, xylocaine admixture should be considered the preferred method for minimizing propofol injection pain, while tapping may be used as a supplementary measure in settings where pharmacological intervention is not feasible.

CONFLICT OF INTEREST: None

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The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.