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COMPARISON BETWEEN ONDANSETRON AND LIDOCAINE IN REDUCING PROPOFOL INJECTION PAIN AT A TERTIARY CARE HOSPITAL

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Abstract

Background: *Propofol injection pain is a common issue during anesthesia. Ondansetron and lidocaine have been used to reduce this pain, but evidence on their comparative effectiveness is inconsistent. This study was planned to directly compare ondansetron and lidocaine in adult patients at a tertiary care hospital to clarify their relative efficacy.*

Objective: *To compare ondansetron and lidocaine in terms of frequency of pain at the time of propofol injection pain at a tertiary care hospital.*

Duration: *Six months w.e.f. 05-05-2024 to 04-11-2024.*

Methodology: *This randomized controlled trial at Hameed Latif Hospital, Lahore, included 124 patients undergoing general surgery, divided equally into ondansetron and lidocaine groups. After ethical approval and consent, patients received pretreatment before propofol injection, and pain was assessed using VNRS. Data were analyzed with SPSS, applying Chi-square tests and stratification for effect modifiers, with $p \leq 0.05$ considered significant.*

Results: *The study included 124 participants (mean age 37.86±11.35 years; 56.5% male) with comparable baseline characteristics between ondansetron and lidocaine groups. Lidocaine significantly reduced propofol injection pain, with lower mean VNRS scores and pain frequency across all age, gender, BMI, and ASA subgroups compared to ondansetron ($p<0.05$).*

Conclusion: *Lidocaine was significantly more effective than ondansetron in reducing propofol injection pain. Pain scores and frequencies were consistently lower across all subgroups, including age, gender, BMI, and ASA status. Both groups were comparable at baseline, confirming that lidocaine provides superior analgesic effect for propofol injection in adult patients.*

INTRODUCTION

Propofol is a phenol derivative and intravenous anesthetic agent with a short duration of action, rapid onset, and quick recovery, making it the drug of choice for almost all surgical procedures.[1] Despite its widespread use and efficacy, propofol injection pain (PIP) remains a common and distressing adverse effect. Although PIP is not considered a serious complication, it is often remembered by patients as one of the most unpleasant experiences during anesthesia. The pain is typically described as sharp, burning, or aching. A panel of expert anesthesiologists ranked PIP seventh among the 33 most important low-morbidity clinical anesthesia problems.[2,3] In addition to discomfort, PIP may provoke anxiety, fear, and distress, and in some cases, it can precipitate cardiovascular complications

such as myocardial ischemia or infarction, thereby compromising patient satisfaction and safety.[3]

Several strategies have been explored to minimize PIP, including modifying the infusion rate, co-administering opioids or nonsteroidal anti-inflammatory drugs, diluting or cooling propofol, and pretreatment with various agents such as lidocaine, ephedrine, ondansetron, metoclopramide, nafamostat mesilate, thiopentone, or ketamine.[4,5] Among these approaches, venous occlusion combined with pretreatment drugs, particularly lidocaine, has been demonstrated to be the most effective method to prevent PIP.[4] Lidocaine acts as a local anesthetic and is commonly used in clinical practice for this purpose. Ondansetron, a specific 5-hydroxytryptamine (5-HT3) receptor antagonist, has also been investigated for its local anesthetic properties. It has been reported that subcutaneous injection of ondansetron produces numbness and exhibits local anesthetic effects approximately 15 times more potent than lidocaine, which may partly explain its antiemetic activity.[5,6]

Several studies have compared the efficacy of lidocaine and ondansetron in reducing PIP. Wasinwong et al. in Thailand reported a significantly lower incidence of PIP in the lidocaine group compared to the ondansetron group (66.2% vs. 82.5%; p=0.001).[7] Similarly, Sumalatha et al. in India found that lidocaine pretreatment reduced the frequency of PIP more effectively than ondansetron (24% vs. 66%; p=0.00002).[8] These findings suggest that lidocaine may be superior in preventing PIP and support its routine use in clinical practice.[7,8]

However, the literature is not entirely consistent. Sureshan et al. in India reported a lower frequency of PIP in patients pretreated with ondansetron compared to lidocaine (10% vs. 32%; p=0.003).[9] Likewise, AbouSlemah et al. in Egypt observed a slightly lower incidence of PIP with ondansetron than with lidocaine (26% vs. 34%), although the difference was not statistically significant (p=0.098).[10] These conflicting results indicate that the superiority of lidocaine versus ondansetron in preventing PIP remains inconclusive, highlighting the need for further investigation.[9,10]

Given the existing controversy and lack of consistent evidence, and to the best of the author's knowledge, no other published local or international study has comprehensively addressed this comparison in the study setting, this trial was planned. The objective of the study was to directly compare the effectiveness of ondansetron and lidocaine in reducing propofol injection pain. Results from this research will provide more definitive guidance for clinicians in selecting the most appropriate pretreatment to minimize PIP, improve patient comfort, enhance satisfaction, and reduce potential complications associated with propofol administration. By clarifying the relative efficacy of these agents, the study aims to support evidence-based anesthesia practice and inform future protocols for the management and prevention of propofol-induced pain.

METHODOLOGY

This study was a randomized controlled trial conducted in the Department of Anesthesiology at Hameed Latif Hospital, Lahore, over a period of six months following the approval of the study synopsis. A total of 124 patients, with 62 cases in each group, were enrolled after calculating the sample size to achieve 80% power and 5% level of significance, considering the expected frequency of propofol injection pain to be 10% in the ondansetron group versus 32% in the lidocaine group.[9]

Non-probability consecutive sampling was employed for participant selection. Patients of both genders, aged 18–60 years, scheduled for general surgery under general anesthesia with ASA physical status I or II were included. Exclusion criteria comprised patients who had difficulty communicating, were allergic to ondansetron, lidocaine, or propofol, did not receive propofol for induction, or had cardiac arrhythmias including prolonged QT syndrome, second- or third-degree atrioventricular block, or chronic pain conditions. The primary objective of the study was to compare ondansetron and lidocaine in terms of the frequency of pain at the time of propofol injection, with pain operationally defined as a verbal numerical rating score (VNRS) of ≥4.

Following approval from the Hospital's Ethical Review Board, patients fulfilling the inclusion criteria were counseled about the study, and written informed consent was obtained. A detailed history was taken, and patients were instructed on the use of VNRS to report injection site pain. Patients were

then randomly assigned to one of two groups using the lottery method: Group A received 4 mg of ondansetron, and Group B received 0.5 mg/kg of lidocaine as pretreatment prior to propofol administration. All patients were kept fasting for six hours for solids before surgery. In the operating theater, a 20-gauge intravenous cannula was inserted into a suitable vein on the dorsal aspect of the non-dominant hand, and Ringer's lactate infusion was initiated. Pretreatment drugs were administered by an anesthesiologist blinded to group allocation to ensure unbiased administration. One minute after pretreatment, a small dose of propofol (50 mg) was infused via a syringe pump at a rate of 600 ml/hr over 30 seconds. The infusion was temporarily stopped, and patients were asked to rate their pain at the injection site using VNRS. Pain scores were recorded before the residual propofol dose was administered, followed by standard administration of opioids and neuromuscular blocking agents according to departmental protocol. Anesthesia for all patients was administered by a single senior anesthesiologist to minimize procedural variability, and all observations were recorded by a single resident under supervision. Confounding variables were controlled through strict exclusion criteria.

Data analysis was performed using SPSS version 17. Numerical variables, including age, BMI, and VNRS score, were presented as mean ± standard deviation, while categorical variables such as gender, ASA class, obesity status, and propofol injection pain were expressed as frequency and percentage. The Chi-square test was applied to compare the frequency of pain between groups, with a p-value ≤0.05 considered statistically significant. To address potential effect modifiers, data were further stratified by age, gender, ASA class, and BMI category, and post-stratification analysis using Chi-square tests was conducted to determine the significance of differences between groups. This methodological approach ensured rigorous assessment of the relative effectiveness of ondansetron and lidocaine in preventing propofol injection pain in adult surgical patients while controlling for confounding factors and minimizing bias through randomization, blinding of drug administration, and standardized anesthesia procedures.

RESULTS

The study included a total of 124 participants with a mean age of 37.86±11.35 years. The majority of participants were aged between 18 and 40 years (75, 60.5%), while 49 participants (39.5%) were aged 41 to 60 years. Regarding gender distribution, 70 participants (56.5%) were male and 54 (43.5%) were female. The mean body mass index (BMI) was 25.44±2.85 kg/m², with 51 participants (41.1%) having a normal weight and 73 participants (58.9%) classified as overweight or obese. In terms of ASA physical status, the participants were equally distributed, with 62 (50.0%) in ASA-I and 62 (50.0%) in ASA-II as give in Group Table 1. The two groups (n=62 each) were comparable in age, gender, BMI, and ASA status, with no statistically significant differences (p>0.05) as given in Table 2. The mean pain score was significantly higher in Group A (ondansetron) at 4.47±1.32 compared to 3.50±1.29 in Group B (lidocaine) (p<0.001). A greater proportion of participants in Group A experienced pain (VNRS ≥4) than in Group B, with 44 (71.0%) versus 27 (43.5%) reporting pain (p=0.002). These results indicate that lidocaine was more effective than ondansetron in reducing propofol injection pain as given in Table 3. When pain was stratified by subgroups, Group B consistently showed lower pain frequencies compared to Group A across all categories. Significant differences were observed in age (18–40 years: 69.2% vs 44.4%, p=0.030; 41–60 years: 73.9% vs 42.3%, p=0.026), gender (male: 70.3% vs 42.4%, p=0.019; female: 72.0% vs 44.8%, p=0.044), BMI (normal weight: 65.5% vs 36.4%, p=0.047; overweight/obese: 75.8% vs 47.5%, p=0.014), and ASA status (ASA-I: 63.6% vs 37.9%, p=0.043; ASA-II: 79.3% vs 48.5%, p=0.012). Similarly, the mean VNRS pain score was significantly lower in each subgroup of Group B compared to Group A (p<0.05), demonstrating that lidocaine was more effective in reducing propofol injection pain across all patient subgroups. Data is given in Table 4.

Table 1: Demographic Characteristics of Patients Included in the Study

Characteristics	Total (124)
Age (years)	37.86±11.35
• 18-40 years	75 (60.5%)
• 41-60 years	49 (39.5%)
Gender	
• Male	70 (56.5%)
• Female	54 (43.5%)
BMI (kg/m^2)	25.44±2.85
• Normal Weight	51 (41.1%)
• Overweight/Obese	73 (58.9%)
ASA Status	
• ASA-I	62 (50.0%)
• ASA-II	62 (50.0%)

Table 2: Comparison of Baseline Characteristics between the Study Groups

Characteristics	Group A (n=62)	Group B (n=62)	p-value
Age (years)	38.18±10.31	37.55±12.39	0.759
• 18-40 years	39 (62.9%)	36 (58.1%)	0.582
• 41-60 years	23 (37.1%)	26 (41.9%)	
Gender			
• Male	37 (59.7%)	33 (53.2%)	0.469
• Female	25 (40.3%)	29 (46.8%)	
BMI (kg/m^2)	25.10±2.80	25.78±2.88	0.186
• Normal Weight	29 (46.8%)	22 (35.5%)	0.201
• Overweight/Obese	33 (53.2%)	40 (64.5%)	
ASA Status			
• ASA-I	33 (53.2%)	29 (46.8%)	0.472
• ASA-II	29 (46.8%)	33 (53.2%)	

Chi Square test / Independent sample t test, taking p-value≤0.05 as significant.

Table 3: Comparison of Study Outcomes between the Groups

Characteristics	Group A (n=62)	Group B (n=62)	p-value
Mean Pain Score	4.47±1.32	3.50±1.29	0.000
Pain (labelled at VNRS≥4)			
• Yes	44 (71.0%)	27 (43.5%)	0.002
• No	18 (29.0%)	35 (56.5%)	

Independent sample t test / Chi Square test, taking p-value≤0.05 as significant.

Table 4.0: Frequency of Pain Stratified for Subgroups
Chi Square test, taking p-vlaue≤0.05 as significant. Likewise, mean pain score on VNRS was significantly less in each sub group of group A than group B (p-value<0.05).

Group	Sub Group	Group A (n=50)	Group B (n=50)	p-value
Age	18-40 years	27/22 (69.2%)	16/36 (44.4%)	0.030
	41-60 years	17/23 (73.9%)	11/26 (42.3%)	0.026
Gender	Male	26/37 (70.3%)	14/33 (42.4%)	0.019
	Female	18/25 (72.0%)	13/29 (44.8%)	0.044
BMI (kg/m^2)	Normal Weight	19/29 (65.5%)	8/22 (36.4%)	0.047
	Overweight/Obese	25/33 (75.8%)	19/40 (47.5%)	0.014
ASA Status	ASA-I	21/33 (63.6%)	11/29 (37.9%)	0.043
	ASA-II	23/29 (79.3%)	16/33 (48.5%)	0.012

DISCUSSION

Propofol injection pain is a common and distressing problem during induction of anesthesia, affecting patient comfort and compliance.[11,12] Various interventions have been proposed to reduce this pain, including ondansetron, a 5-HT3 receptor antagonist, and lidocaine, a local anesthetic.[13,14] While several studies have reported variable efficacy of these agents, the literature remains inconclusive regarding which is superior, with some trials favoring lidocaine and others showing comparable effects.[7-10] To address this controversy, this study was planned to directly compare the effectiveness of ondansetron and lidocaine in reducing propofol injection pain among adult patients at a tertiary care hospital, aiming to provide clearer clinical guidance.

Several studies have highlighted the superior effectiveness of lidocaine in reducing propofol injection pain. Sumalatha et al. reported that both lignocaine (2%) and ramosetron significantly decreased the incidence and intensity of pain compared to ondansetron, with the incidence of no pain (VNRS score 0) being 76% in the lignocaine group versus 34% in the ondansetron group (P<0.001). The study concluded that intravenous lignocaine and ramosetron were more effective than ondansetron in preventing propofol induced pain (PIP), while pre-treatment with ramosetron was comparable to lignocaine.[8] Similarly, Ayub et al., in a study involving 490 patients, found that lidocaine pre-treatment reduced the incidence of PIP in 76% of patients compared to 64% in the ondansetron group. They emphasized lidocaine as a simple, safe, and effective method to reduce propofol pain without introducing additional drugs that could have undesirable effects.[14]

Kanojia et al. also reported superior outcomes with lignocaine, noting a mean pain score of 0.02±0.14 in the lignocaine group versus 0.38±0.57 in the ondansetron group during the first five seconds of propofol injection (p<0.001). Additionally, post-operative nausea and vomiting (PONV) scores were significantly lower in patients receiving lignocaine, suggesting dual benefits in both pain reduction and postoperative comfort.[15] Similarly, Ashfaq et al. demonstrated that only 15% of patients in the lignocaine group reported severe pain compared to 32% in the ondansetron group (p<0.001). While ondansetron occasionally led to short-term hypotension and bradycardia, lignocaine administration was generally safe, with only mild skin reactions observed. These findings reinforce the consistent analgesic advantage of lignocaine over ondansetron in preventing PIP.[16]

However, other studies suggest that ondansetron may be an effective alternative. Rayasam et al. reported comparable efficacy between lignocaine and ondansetron, with no pain observed in 54% of patients in the lignocaine group and 60% in the ondansetron group. Moderate pain occurred in 10% of patients in both groups, and severe pain was slightly higher in the ondansetron group (6% vs 2%), though these differences were not statistically

significant.[17] Sureshan et al. similarly observed that both lignocaine and ondansetron 4 mg reduced the incidence and intensity of pain, with lignocaine showing slightly better relief. However, when combined with venous occlusion, ondansetron provided substantial pain reduction, supporting its role as a viable alternative, particularly in patients where lignocaine use may be contraindicated.[9]

Contradictory findings have also been reported. AbouSlemah et al. found that the incidence of pain was slightly higher in the lignocaine group (34%) compared to the ondansetron group (26%), though the difference was not statistically significant. Severe and moderate pain levels were comparable between both groups, suggesting that ondansetron and lignocaine could be similarly effective under certain circumstances. These variations in outcomes may be attributable to differences in study design, sample size, dosing, injection speed, and patient characteristics.[10]

Evidence from Wasinwong et al. in Thailand further supports the superior efficacy of lignocaine. They reported that the incidence of pain was lowest in the lignocaine group (66.2%) compared with the ondansetron (82.5%) and control groups (85%) ($P<0.01$). Median pain scores and the distribution of no, mild, moderate, and severe pain favored lignocaine, confirming its role as the more effective pretreatment agent for reducing both the incidence and severity of PIP.[7]

Overall, the collective evidence indicates that while ondansetron can reduce propofol injection pain and may serve as an alternative, lignocaine consistently demonstrates superior efficacy in preventing and attenuating PIP. The choice of agent should consider patient-specific factors, potential side effects, and institutional protocols. Lidocaine remains a preferred first-line option due to its rapid onset, predictable effect, and additional benefit in reducing postoperative nausea. However, ondansetron may be considered in scenarios where lignocaine is contraindicated or when additional antiemetic benefits are desired.

CONCLUSION

Lidocaine was significantly more effective than ondansetron in reducing propofol injection pain. Pain scores and frequencies were consistently lower across all subgroups, including age, gender, BMI, and ASA status. Both groups were comparable at baseline, confirming that lidocaine provides superior analgesic effect for propofol injection in adult patients.

LIMITATIONS & RECOMMENDATIONS

This study's strength lies in its direct comparison of ondansetron and lidocaine for propofol injection pain, with well-matched baseline characteristics and clear outcome measures. Limitations include a single-center design, limited sample size, and exclusion of certain patient populations, which may affect generalizability. Future research should explore larger multicenter trials, optimal dosing strategies, combination therapies, and long-term safety profiles to further refine pain management protocols and enhance patient comfort during propofol administration.

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Authors Contribution

Author 1

Substantial contributions to study design, acquisition of data
Analysis & Interpretation of Data, Manuscript writing
Has given final approval of the version to be published
Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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integrity of any part of the work are appropriately investigated and resolved

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