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Original Research Article

Comparison of Prior Administration of Intravenous Dexmedetomidine and Lidocaine on Pain during Propofol Injection for Induction of General Anaesthesia in Patients Undergoing Elective Oral and Maxillofacial Surgery

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Abstract: *Pain upon propofol injection is a common adverse effect during induction of anaesthesia. Lidocaine and dexmedetomidine are frequently used to mitigate this discomfort, but their comparative efficacy remains unclear.* ***Objective:*** *To compare the effectiveness of intravenous lidocaine and dexmedetomidine in reducing pain intensity due to propofol injection in patients undergoing elective oral and maxillofacial surgery.* ***Methodology:*** *This prospective study was conducted in the Department of Anesthesia and ICU at Nishtar Medical University, Multan, from June 7 to December 7, 2023. A total of 190 patients were randomly assigned to two groups: Group A received dexmedetomidine, and Group B received lidocaine. Baseline parameters, including gender, age, BMI, obesity, ASA physical status, and residential area, were recorded. Pain intensity during propofol injection was assessed and compared between the groups using the chi-square test, with a p-value ≤ 0.05 considered statistically significant.* ***Results:*** *The mean BMI was 26.50 ± 1.68 kg/m² in Group A and 25.98 ± 2.10 kg/m² in Group B, with obesity present in 9.5% and 11.6% of patients, respectively. Diabetes was observed in 10.5% of Group A and 12.6% of Group B. ASA physical status type I was noted in 83.2% of Group A and 80% of Group B. Pain was absent in 56.8% of patients in Group A and 62.1% in Group B, showing no statistically significant difference (p > 0.05).* ***Conclusion:*** *Both lidocaine and dexmedetomidine are equally effective in reducing pain associated with propofol injection and can be used interchangeably without significant adverse effects.*

Keywords: Propofol, Dexmedetomidine, lidocaine, Pain, Maxillofacial surgery.

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Introduction

Pain is an unpleasant sensation that can be highly distressing for patients, and pain associated with propofol injection is a common and significant issue (1). Despite this, propofol remains the most widely used intravenous anaesthetic for induction of anaesthesia during sedation and maintenance of general anaesthesia due to its rapid onset and quick recovery profile (2). However, the pain caused by its injection is a well-documented concern, with studies indicating that 28% to 90% of patients receiving propofol through the dorsal hand vein experience varying degrees of pain intensity (3). Furthermore, many anesthesiologists rank this pain as the 7th among anesthesia-related 33 complications based on its clinical relevance and frequency (4).

The pain from propofol injection not only affects the patient's comfort but may also influence the overall quality of anaesthesia, making it an unpleasant and memorable part of the anaesthetic experience (5). Various methods have been explored to reduce the pain associated with propofol injection, including diluting the solution, warming, cooling, and using more prominent veins. Some pharmacological techniques are also in practice, like pre-injection of ketamine, ephedrine, thiopental, flurbiprofen, opioids, magnesium, granisetron, ondansetron, metoclopramide, benzodiazepine, lidocaine, use of a tourniquet or not, have been evaluated, though their results vary. Among these methods, lidocaine pretreatment remains the most widely used for alleviating pain due to propofol injection (6, 7).

However, recent studies have demonstrated that dexmedetomidine (Dex), a highly selective alpha-2 adrenoceptor agonist with analgesic, soothing, and sympatholytic properties, is equally effective in reducing propofol-induced pain (8). Non-pharmacological strategies include a controlled dose of Propofol, slow administration, and selection of an antecubital vein. Additionally, research indicates that the injection temperature may influence the pain intensity (9). While propofol is typically stored at 25°C and can be warmed to 37°C, which may alter its chemical structure, 40 °C cooling is a suitable temperature (10).

Few studies have assessed the role of lidocaine and dexmedetomidine in alleviating injection-related propofol pain. Combination therapy is recommended over lidocaine alone. This study aims to evaluate IV Dexmedetomidine before propofol induction at 4°C versus lidocaine alone. It will help anesthesiologists choose effective prophylactic therapy to prevent propofol-related pain, reducing patient suffering and complications.

Methodology

After obtaining ERB approval, the study was conducted in the Department of Anesthesia and ICU at Nishtar Medical University, Multan, from June 7 to December 7, 2023. The pain was assessed using the Verbal Categorical Scale (VCS), a four-point scale ranging from 0 (no pain) to 3 (severe pain with behavioural signs). Pain scores were recorded 10 seconds after propofol injection. Obesity was defined using a BMI above 27.5 kg/m², and was classified as obese, following WHO criteria. Diabetes was identified in patients who had

been using hypoglycemic therapy (oral medications or insulin) for more than two years.

The sample size was calculated using OpenEpi using 95% CI and 80% power. Based on a 49% proportion of no pain in the combination group and a 29% proportion in the lidocaine group, the required sample size was 190 patients, with 95 patients in each group. Non-probability consecutive sampling was used.

Inclusion criteria included adult patients aged 18 to 55 years undergoing elective oral and maxillofacial surgery, with ASA grades I or II, of both genders. Exclusion criteria included hypersensitivity to the study drugs, impaired mentation with a Glasgow Coma Scale (GCS) score below 12, and patients who did not provide consent.

All patients underwent a thorough preoperative assessment, which included a physical examination, baseline investigation, and detailed history. Informed consent was obtained from each patient, who was informed about the study's objectives, assured of the confidentiality of their information, and guaranteed that no risk would be involved in their participation. Patients were also educated about the Verbal Categorical Scale (VCS) as defined in the operational protocol.

In Group A, patients received an injection of dexmedetomidine at a dose of 0.5 µg/kg dissolved in 50 ml of distilled water, followed by an infusion of propofol at a dose of 0.5 mg/kg cooled to 4°C. In Group B, patients received an injection of lidocaine at a dose of 40 mg dissolved in 10 ml of distilled water, followed by an infusion of propofol at a dose of 0.5 mg/kg at room temperature. Anaesthesia induction was performed according to standard hospital protocols by a senior anaesthetist, and patients were blinded to their group assignment. The researcher documented all findings in a specially designed proforma.

Data were analysed using SPSS version 23. The chi-square test compared pain absence between groups, with $p \leq 0.05$ as significant. Stratification controlled effect modifiers (gender, age, etc.), and the chi-square test assessed their impact on pain, using $p \leq 0.05$ as significant.

Results

Among 190 patients, mean age in Group A was 41.44 ± 8.23 years, while in Group B, it was 39.43 ± 8.62 years. In Group A, 59 patients (62.1%) were male, and 36 (37.9%) were female, whereas Group B had 62 males (65.3%) and 33 females (34.7%). Among Group A patients, 37 (38.9%) were from rural areas, and 58 (61.1%) were from urban areas, while Group B had 46 rural (48.4%) and 49 urban (51.6%) residents. The mean BMI was 26.50 ± 1.68 kg/m² in Group A and 25.98 ± 2.10 kg/m² in Group B, with obesity present in 9 (9.5%) Group A patients and 11 (11.6%) in Group B. Diabetes was observed in 10 (10.5%) Group A patients and 12 (12.6%) in Group B. ASA physical status type I was noted in 79 patients (83.2%) in Group A and 76 patients (80%) in Group B Table 1. The results showed that 54 patients (56.8%) in Group A reported no pain, compared to 59 patients (62.1%) in Group B, Table 2. Pain outcomes were stratified by age, gender, residential status, obesity, diabetes, and ASA physical status. Table 3

Table 1: Demographics and essential study variables

Characteristics	Group A	Group B
Age	414±8.23	39.43±8.62
Male	59 (62.1)	65 (65.3)
Female	36 (37.9)	33 (34.7)
Rural	37 (38.9)	46 (48.4)
Urban	58 (61.1)	49 (51.6)
Obesity	09 (9.5)	11 (11.6)
Diabetes (DM)	10 (10.5)	12 (12.6)
ASA Type I	79 (83.2)	76 (80)
ASA Type II	16 (16.8)	19 (20)

Table 2: Comparison of pain between groups. (n = 190)

Pain (n=190)	Group A		Group B		*P* - value
	Frequency	Percentage	Frequency	Percentage	
Yes n= 77 (40.5%)	41	43.2	36	37.9	0.460
No n= 113 (59.5%)	54	56.8	49	62.1	
Total	95	100	95	100	

Table 3: Obesity with regards to pain between groups. (n = 190)

Obesity (n=190)	Pain	Groups		*P* – value
		Group A (n=95)	Group B (n=95)	
Yes (n=20)	Yes (n=09)	04	05	0.964
	No (n=11)	05	06	
No (n=170)	Yes (n=68)	37	31	0.416
	No (n=102)	49	53	

Discussion

Propofol injection pain is a significant concern during anaesthesia induction. Propofol, an effective anaesthetic, contains a phenol group that causes immediate or delayed pain. Immediate pain results from irritated afferent nerve endings in the venous intima and mucous membranes (11). Delayed pain is linked to the activation of the kallikrein-kinin system, producing bradykinin, which increases local vasodilation and hyperpermeability. However, some studies suggest bradykinin generation is not entirely associated with propofol injection pain (12).

Yu et al. (13) reported that Dex + 4°C propofol significantly reduced pain (49%) compared to other groups, including placebo (6%) and lidocaine + room temperature propofol (29%) ($p< 0.001$). In this study mean age was 41.44 ± 8.23 and 39.43 ± 8.62 years in groups A and B, with ages ranging from 18 to 55 years. Hossain et al. (14) reported slightly lower mean ages of 38.23 ± 8.12 years in the dexmedetomidine group and 37.65 ± 9.32 years in the placebo group. Sapate et al. (9) found similar results, with mean ages of 45.4 ± 16.11 years in the dexmedetomidine group and 40.72 ± 13.96 years in the lignocaine group.

Jandial et al. (7) reported mean ages of 39.51 ± 11.18 years in the dexmedetomidine group and 42.6 ± 9.57 years in the lignocaine group, supporting our findings. In our study, 88.4% (n=84) of Group B patients were older than 30. Wanget al. (6)similarly reported 86% of patients aged 31–59, consistent with our results.

In our study, 62.1% were male in Group A and 65.3% in Group B, while females were 37.9% and 34.7%, respectively. This differs from Togawa et al., who reported equal gender distribution, and Wanget al (6), who found female predominance with 282 (63%) in China. These differences may be attributed to our country's lower literacy rate and male-dominant culture. However, our findings align with a study by Hossain et al. (14) in Bangladesh, which reported 62.5% and 65% male dominance in Groups A and B, respectively.

In our study, most participants were from urban areas (58, 61.1% in group A and 49, 51.6% in group B). The mean BMI was 26.50 ± 1.68 kg/m² for group A and 25.98 ± 2.10 kg/m² for group B. Obesity was observed in 9 (9.5%) of group A and 11 (11.6%) of group B. These findings align with those of Ye et al. (15) (62.26% urban patients) and are consistent with Qureshi et al. (16) (BMI 26.31 ± 5.09 kg/m²) and Sargin et al. (2) (group BMI 27.01 ± 3.31 kg/m², control 25.81 ± 3.47 kg/m²). Contrastingly, Wahid et al. (17) found that most patients were from rural areas (59.3%), while Siddiqui et al. (18) reported a higher urban population (91.3%).

In our study, diabetes was present in 10 (10.5%) cases in group A and 12 (12.6%) in group B. ASA physical status I was observed in 79 (83.2%) groups A and 76 (80%) B. Sargin et al. (2) reported similar findings, with 10% of patients having diabetes and equal distribution of ASA status in group A. Jandial et al. (7) found different results in Group A but similar results in Group B. Hossain et al. (14) in Bangladesh found that 90% of patients in the dexmedetomidine group and 92.5% in the saline group had ASA I, similar to our study. Jandialet al. (7) also reported that most ASA I patients in the Dex+4°C propofol group (84.1%) and the lidocaine group (79%) were consistent with our findings.

In our study, 56.8% of patients in Group A and 62.1% in Group B reported no pain. Similar results were reported by Sapate et al. (9), where 50% of the dexmedetomidine group and 60% of the lignocaine group had no pain. A study by Jandialet al (7) in Jammu & Kashmir found that 57.1% in the dexmedetomidine group and 62.8% in the lignocaine group had no pain, which aligns with our findings.

Conclusion

Injection lidocaine and dexmedetomidine are equally effective and can be used as an alternative for relieving pain associated with propofol injection without causing any significant adverse effects.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-NMCM-0342d-24)

Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

TM (PGR), MAF (Associate Professor), MUM (Associate Professor)
Manuscript drafting, Study Design, Review of Literature, Data entry, Data analysis, drafting article.
MKS (Associate Professor), *Conception of Study, Development of Research Methodology Design,*
MA (Associate Professor), AS (SR)
Study Design, manuscript review, Manuscript revisions, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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