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# EFFECTIVENESS OF DEXMEDETOMIDINE VERSUS TRAMADOL AS PRE-TREATMENT IN ALLEVIATING PROPOFOL INJECTION PAIN: A COMPARATIVE STUDY

Anaesthesiology

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## ABSTRACT

**Introduction:** Propofol injection pain is common and distressing, with incidence up to 28-90%. This study aims to compare effectiveness of dexmedetomidine and tramadol as pre-treatment agents in alleviating propofol injection pain. **Methods:** The study was conducted on 60 adult patients aged 20–50 years, classified as ASA physical status I and II, scheduled for elective surgeries under general anaesthesia. Patients were randomly assigned into two groups of 30 each. Group D received dexmedetomidine 0.25 µg/kg, while Group T received tramadol 50 mg , both administered intravenously 1 minute before propofol induction. Propofol (2 mg/kg) 25% of total dose was then injected, and pain severity was assessed using a McCririck and Hunter Scale - a 4-point verbal rating scale (0 = no pain, 3 = severe pain).**Results:** The incidence and intensity of propofol injection pain were significantly lower in the dexmedetomidine group compared to the tramadol group ($p < 0.05$). Additionally, haemodynamic parameters remained stable in both groups without significant adverse effects. **Conclusion:** Dexmedetomidine was more effective than tramadol in reducing the incidence and severity of propofol injection pain with stable haemodynamics, suggesting its potential as a preferred agent in clinical anaesthetic practice.

## KEYWORDS

Dexmedetomidine, Tramadol, Propofol Injection Pain, Pre-treatment, Anaesthesia.

## INTRODUCTION

Propofol is a widely used intravenous anaesthetic due to its rapid onset and short duration of action. One of its most common drawbacks is the pain experienced during injection, which occurs in 28% to 90% of patients. This is primarily due to activation of the kallikrein-kinin system, leading to bradykinin release, vasodilation, and increased endothelial permeability, exposing nerve endings to the aqueous phase of propofol. Various methods have been explored to mitigate this pain, including pretreatment with lidocaine, opioids, antiemetics, magnesium sulfate, and others. Recently, the alpha-2 adrenergic agonist dexmedetomidine and centrally acting analgesic tramadol have gained interest due to their additional sedative and analgesic properties.This study aims to compare effectiveness of dexmedetomidine and tramadol as pre-treatment agents in alleviating propofol injection pain.

## MATERIALS AND METHOD SOURCE OF DATA:

Patients scheduled for General Anaesthesia in Sapthagiri institute of medical sciences and research centre.

**Study Design:** A COMPARATIVE STUDY

**Place Of Study:** Sapthagiri institute of medical sciences and research centre, Bengaluru, Karnataka.

**Inclusion Criteria:**

- Age between 20-50 years.
- ASA I and II patients .
- Posted for elective surgery under general Anaesthesia

**Exclusion Criteria**

- Pregnant and lactating women.
- Patients with hypersensitivity or allergies to Dexmedetomidine, Propofol or Tramadol.
- Diabetes, cardiovascular diseases, liver and kidney disorders, psychiatric disorders.

## METHODOLOGY:

**Ethical Considerations :**

Ethical approval from Ethical committee of our Institute and Informed consent taken from all participants

**RANDOMISATION:**

Group D - Those who will be given IV Dexmedetomidine (0.25mcg/kg)

Group T- Those who will be given IV Tramadol (50mg)

**Preparation -**

Venous access with 18 gauge intravenous catheter -Standard monitoring including electrocardiogram, noninvasive blood pressure and pulse oximetry applied and Baseline vitals were noted.

**General Anaesthesia :**

Patients were preoxygenated with 100% O2 for 3 minutes before induction. A pneumatic tourniquet at 70 mmHg was applied on the same arm as the intravenous cannula and the study drug was given intravenously over 10 seconds, i.e., IV Dexmedetomedine (0.25mcg/kg) in Group D and IV Tramadol (50mg) in Group T. 60 seconds after pretreatment, tourniquet was released and the first 25% of calculated dose (2mg/kg) of propofol was injected immediately IV over 10 seconds . Pain assessment was done 5 seconds after injection of 25% of calculated dose before the loss of verbal contact using Verbal Rating Scale (VRS) and graded it as 0 to 3 with scale advocated by McCrirrick and Hunter and noted into case record.This was considered the end point of our study. The standard protocol was followed for the later part of general anaesthesia procedure. When surgery was completed general anesthesia was reversed as usual. Patients were monitored intraoperatively and post operatively for any untoward complications or adverse effects.

**ASSESSMENT**

Pain during Propofol injection was assessed after 5 seconds of injection by Anaesthesiologist before the loss of verbal contact using Verbal Rating scale

0- No pain

1-Mild pain (pain reported only in response to questioning without any behavioral signs)

2-Moderate pain (pain reported in response to questioning and accompanied by a behavioral sign or pain reported spontaneously without questioning).

3- Severe pain (strong vocal response or response accompanied by facial grimacing, arm withdrawal or tears).

**Statistical Analysis:**

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp., was used to perform statistical analyses.

**Descriptive Statistics:**

Descriptive analysis of all the explanatory and outcome parameters was done using mean and standard deviation for quantitative variables, frequency and proportions for categorical variables.

**Inferential Statistics:**
Mann Whitney / Independent Student t Test was used to compare the mean age, mean weight, mean values of different vital parameters between 2 groups. Chi Square Test was used to compare the gender distribution, ASA grade and Incidence and severity of pain following propofol injection between two groups between 2 groups. The level of significance will be set at P<0.05.

## RESULTS

The Demographic and Clinical characteristics of the two study groups, Group D and Group T, are closely matched both groups have similar mean ages 35 ± 9 and 34 ± 9 (p=0.65). A balanced male-to-female ratio (p=0.79), and comparable distributions of ASA physical status classifications ASA I and II (p=0.56). The p-values for age, gender, and ASA status all indicate no statistically significant differences between the groups, confirming that they are well-matched at baseline. The results show a significant difference in the Incidence and Severity of Propofol injection pain between the Dexmedetomidine group (n=30) and the Tramadol group (n=30). In the Dexmedetomidine group, a large majority (25 patients, 83.3%) reported experiencing no pain, whereas only 5 patients (16.7%) in the Tramadol group reported no pain, a difference that is highly statistically significant (p<0.001). Mild pain was observed in 5 patients (16.7%) in the Dexmedetomidine group compared to 15 patients (50%) in the Tramadol group (p=0.01). More severe grades of pain were almost absent in the Dexmedetomidine group: no patients in this group experienced moderate or severe pain. In contrast, 8 patients (26.7%) in the Tramadol group had moderate pain (p=0.005), and 2 patients (6.7%) had severe pain (p=0.04).

The hemodynamic parameters and oxygen saturation remained stable in both groups throughout the study. Mean arterial pressure ranged from 95/96 mm Hg at baseline to 106/107 mm Hg post-intubation. Heart rate was similar between groups, from 79/80 beats per minute at baseline to 90/92 post-intubation. Oxygen saturation ($SpO_2$) remained high throughout, with values of 98/98% at baseline and 99/98% post-intubation. There were no statistically or clinically significant differences between the 2 groups at any point of time (p > 0.05), and none of the changes required intervention.

**Table 1: Demographic And Clinical Characteristics Of The Study Groups**

| Variables | Group DEX (n=30) | Group TRAM (n=30) | p value |
|---|---|---|---|
| Age (years) | 35 ± 9 | 34 ± 9 | 0.65 (NS) |
| Gender (n, %) | | | 0.79 (NS) |
| Male | 13 (43.3%) | 12 (40%) | |
| Female | 17 (56.7%) | 18 (60%) | |
| ASA Physical Status (n, %) | | | 0.56 (NS) |
| ASA I | 21 (70%) | 20 (66.7%) | |
| ASA II | 9 (30%) | 10 (33.3%) | |

**Table 2: Incidence And Severity Of Propofol Injection Pain In Two Groups**

| Pain Severity | Dexmedetomidine Group (n=30) | Tramadol Group (n=30) | p-value |
|---|---|---|---|
| No Pain | 25 (83.3%) | 5 (16.7%) | <0.001 |
| Mild Pain | 5 (16.7%) | 15 (50%) | 0.01 |
| Moderate Pain | 0 (0%) | 8 (26.7%) | 0.005 |
| Severe Pain | 0 (0%) | 2 (6.7%) | 0.04 |

**Table3: Hemodynamic And Oxygen Saturation Parameters At Different Stages In Study Groups**

| Parameter | Baseline (Group D / T) | Pre-Intubation (Group D/ T) | Post-Intubation (Group D/ T) |
|---|---|---|---|
| Mean Arterial Pressure (mm Hg) | 95 / 96 | 89 / 91 | 106 / 107 |
| Heart Rate (beats per minute) | 79 / 80 | 75 / 76 | 90 / 92 |
| $SpO_2$ (%) | 98 / 98 | 98 / 97 | 99 / 98 |

## DISCUSSION

Propofol can induce pain through direct stimulation and activation of the kallikrein-kinin system, activation of nociceptive cis-receptor potential ion channels, and changes in osmotic pressure. We used the tourniquet at 70 mmHg for 60 seconds which was considered as an important tool in isolation of arm vein from rest of circulatory system to study the peripheral action of the drug in absence of its central action. It also allows the analgesics to act upon the endothelial nociceptors, the key site of local anti-nociceptive action. The possible mechanism involved in decreasing propofol injection pain by dexmedetomidine might be due to alpha1 and alpha2 stimulation causing release of vasodilator prostaglandins that antagonize the vasoconstrictor response. This modulation of the sympathetic response of the venous smooth muscle might be important in endothelial dysfunction caused by propofol. It may be due to hyperpolarization-activated conductance in the peripherally mediated antinociception, but the peripheral analgesic effects of dexmedetomidine have not yet been fully elucidated.Tramadol is a centrally acting weak μ-opioid receptor agonist and inhibits noradrenaline reuptake likewise promotes serotonin release and reduced pain. In our study, the overall incidence and severity of pain were significantly less in dexmeditomidine group compared to tramadol group. In the Dexmedetomidine group, a large majority (25 patients, 83.3%) reported experiencing no pain, whereas only 5 patients (16.7%) in the Tramadol group reported no pain, a difference that is highly statistically significant (p<0.001). Mild pain was observed in 5 patients (16.7%) in the Dexmedetomidine group compared to 15 patients (50%) in the Tramadol group (p=0.01). More severe grades of pain were almost absent in the Dexmedetomidine group: no patients in this group experienced moderate or severe pain. In contrast, 8 patients (26.7%) in the Tramadol group had moderate pain (p=0.005), and 2 patients (6.7%) had severe pain (p=0.04). These results confirm the superior analgesic efficacy of dexmedetomidine as a pre-treatment agent.Hemodynamic parameters and $SpO_2$ remained stable across both groups, indicating that both dexmedetomidine and tramadol are safe for use during induction of general anesthesia. The absence of adverse effects or significant physiological changes supports the clinical acceptability of both agents, with dexmedetomidine offering an added advantage of pain relief without compromising patient safety.This study supports previous research highlighting dexmedetomidine's superior efficacy in reducing propofol injection pain. Studies by Hossain et al. (2019) and Liang He et al. (2014) demonstrated its effectiveness over placebo and lidocaine, respectively. In contrast, Bukhari et al. (2016) found tramadol less effective. These findings reinforce dexmedetomidine's potential as a preferred agent in anaesthesia due to its combined analgesic and sedative properties.

## CONCLUSION

Dexmedetomidine showed superior efficacy over tramadol in attenuating propofol injection pain with significantly fewer pain responses and a greater proportion of patients experiencing no discomfort. Both agents maintained stable hemodynamic and oxygenation parameters, confirming their safety during induction. However tramadol was less effective with higher incidences of mild to moderate pain. Overall dexmedetomidine emerges as a more effective and reliable pre-treatment option for improving patient comfort during anaesthesia induction.

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