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ORIGINAL RESEARCH AIRWAY MANAGEMENT

# Comparison of dexmedetomidine, fentanyl, and lidocaine in attenuation of hemodynamic responses during intubation in patients undergoing laparoscopic cholecystectomy

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## ABSTRACT

**Background & objective:** The anesthesiologists have been trying various strategies to lessen the adverse effects of endotracheal intubation on hemodynamic parameters. The aim of this study was to explore a better and safer drug to attenuate the pressor response to laryngoscopy and intubation by comparing dexmedetomidine (Precedex; Brookes Pharma), fentanyl (Fentra; Brookes Pharma), and lidocaine (Xylocaine; Barret Hodgson).

**Methodology:** In this double-blind, randomized controlled trial, a total of 90 patients of ASA physical status I and II, undergoing laparoscopic cholecystectomy under general anesthesia were included. Sample size was calculated using OPEN EPI sample size calculator. Patients were randomized into three groups by sealed envelope method. Patients in Group D received intravenous dexmedetomidine 0.6 µg/kg, Group F received intravenous fentanyl 2 µg/kg and Group L received intravenous lidocaine 1.5 mg/kg over 10 min before induction. Hemodynamic variables were recorded at baseline, at laryngoscopy, 1, 3, 5 and 10 min after intubation. Perioperative complications and postoperative sedation and recovery were also noted at 0 and 10 min in Post Anesthesia Care Unit (PACU).

**Results:** As compared to dexmedetomidine, there was no significant impact of lidocaine (P = 0.774) and fentanyl (P = 0.992) in managing the heart rate (HR) of patients, while time had a significant impact on the HR. There was no substantial effect of fentanyl (P = 0.123) or lidocaine (P = 0.616) in managing SBP and no effect of fentanyl (P = 0.580) or lidocaine (P = 0.752) in managing DBP, in contrast to dexmedetomidine. Although statistically significant reduction in HR, SBP and DBP was observed in Group D, soon after study drug infusion, but overall long-term stability was noticed. Ramsey sedation scores were significantly higher in the Group D at arrival in PACU, but after 10 min all three

 

study groups showed almost similar results. Aldrete score was statistically significant in the fentanyl group compared to Group D and L in PACU, both at arrival and after 10 min (P = 0.001 and 0.010 respectively).

**Conclusion:** We conclude that intravenous dexmedetomidine demonstrated better attenuation of hemodynamic response to laryngoscopy and intubation in patients undergoing laparoscopic cholecystectomy by controlling rise in heart rate and by providing long-term stability in systolic and diastolic blood pressure. Fentanyl and lidocaine showed inconsistencies in heart rate, systolic and diastolic blood pressure over time. Fentanyl showed better hemodynamic profile compared to lidocaine. Patients included in fentanyl group exhibited early recovery than dexmedetomidine and lidocaine.

**Abbreviations:** ASS - Aldrete sedation score; HR - heart rate; PACU - Post Anesthesia Care Unit; PONV - postoperative nausea and vomiting; RSS - Ramsay sedation scale;

**Keywords:** Attenuation, Dexmedetomidine, Fentanyl, Hemodynamic Response, Intubation Response, Laryngoscopy Response, Lidocaine, Pressor Response.

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# 1. INTRODUCTION

Laparoscopic surgeries form an essence of modern surgical practices due to minimal scarring, less pain in the postoperative period, shorter hospital stays, and reduced morbidity and mortality; and thus, have become the gold standard for many gallbladder surgeries.[1] The key component in the anesthetic management of these procedures is the maintenance of the definitive airway, which is the critical component in providing intact functional respiration and hemodynamic monitoring and management.[2,3]

Laryngoscopy and endotracheal intubation are often associated with intense sympathoadrenal stimulation resulting in hypertension and tachycardia, which usually last for 5 to 10 min.[4] Hemodynamic changes after laryngoscopy and intubation are due to sympathoadrenal discharge of catecholamines caused by stimulation of the oropharynx and parapharynx.[5] These changes are usually well tolerated in young healthy adults but can be life-threatening in patients with comorbidities, intracranial hypertension, and cardiac disease. Cerebral stroke, myocardial infarction, and left ventricular dysfunction can occur in patients with high risks. A wide variety of pharmacological and nonpharmacological measures have been tried and tested to prevent this response.[4] Deep planes of anesthesia at the time of intubation and smooth, swift laryngoscopy are included in the nonpharmacological measures.[6-8]

Among pharmacological agents, dexmedetomidine (Precedex®; Brookes Pharma) is a relatively newer agent and is an imidazole-derivative adrenoceptor agonist and shows high selectivity for alpha-2 receptors.[8] It is associated with sedation, memory loss, and

reversible analgesia, and it produces no cardiopulmonary side effects. Dexmedetomidine has been shown to reduce the prevalence of emergence agitation when administered after induction of anesthesia.[9] It has also been reported to lower the arterial blood pressure and heart rate (HR). Research is ongoing at the international level, and dexmedetomidine has been added as an adjuvant in general anesthesia to blunt hemodynamic and hormonal responses.[10-12]

Opioids specifically are useful in attenuation of this cardiovascular response, they may cause respiratory depression and rigidity, or may prolong recovery times. Fentanyl (Fentra®; Brookes pharma), is a synthetic pure μ-receptor agonist, and it takes less time to reach its peak analgesic effect. It has a broader safety margin, minimal respiratory depression at analgesic doses, and its effect rapidly terminates after small bolus doses. It is a relatively cardiovascular stable drug [5,13].

Lidocaine (Xylocaine®; Barret Hodgson) is a systemic local amide anesthetic used as an antiarrhythmic agent, and it has been used in several studies for blunting cardiovascular response secondary to intubation and laryngoscopy.[6,14]

In this randomized controlled trial, we compared the effectiveness of preoperative administration of dexmedetomidine, lidocaine, and fentanyl boluses in blunting the hemodynamic response following laryngoscopy and endotracheal intubation.

 

# 2. METHODOLOGY

The current study is a prospective, double-blind, randomized controlled clinical trial and was registered with clinicaltrials.gov NCT04138472. The study was proceeded in elective Operation theatres at Dr. Ruth K.M. Pfau Civil Hospital in Karachi, after receiving approval from the institutional review board (IRB-1381/DUHS/Approval/2019) and written informed consent from the patients.

Ninety patients were enrolled in this study after calculating sample size using OPEN EPI sample size calculator. All patients scheduled for elective laparoscopic cholecystectomy and meeting the inclusion criteria were instructed on the study protocols. Patients of either gender, age between 20 to 70 y, ASA physical status class I or II were included in the study. Patients with a body mass index >35 kg/$m^2$, anticipated difficult intubation and Mallampati class III and IV were excluded from the study, as difficult intubation takes longer time and is invariably associated with marked hemodynamic changes despite being well pre-medicated. Patients with severe cardiorespiratory disease, geriatric age group and those on antihypertensives were excluded as they show extreme fluctuations in presser response to laryngoscopy and intubation. Metabolism of $\alpha_2$-agonists occurs in the liver, and excreted in the urine. Therefore, we excluded patients with altered liver and renal functions. Patients on benzodiazepines, tricyclic antidepressants, history of drug abuse or allergy to study drugs were also excluded from the study.

Patients were selected by non-probability sampling technique and randomly divided into three equal groups. Randomization was done through an opaque sealed envelope method performed by an independent anesthetist who was not involved in the treatment or follow up. Both study drugs were kept in the hospital pharmacy and provided before use. The same anesthetist prepared the study drugs in syringes with identical appearance as follow:

Group D (n = 30) received dexmedetomidine 0.6 µg/kg in 100 mL of 0.9% normal saline over 10 min before laryngoscopy.

Group F (n = 30) received fentanyl 2 µg/kg in 100 mL of 0.9% normal saline over 10 min before laryngoscopy.

Group L (n = 30) received lidocaine 1.5 mg/kg in100 mL of 0.9% normal saline over 10 min before laryngoscopy.

All patients were given tablet alprazolam 0.5 mg at bedtime, the night prior to surgery. Routine standard multiparameter patient monitors for HR, noninvasive blood pressure (NIBP), continuous three leads electrocardiography, and oxygen saturation ($SpO_2$) were applied, and baseline readings were noted. Peripheral venous access was secured for administration of the study drug and subsequent fluid infusion.

Patients were given the study drug by the primary anesthetist who was not involved in its preparation. The study drugs were prepared by assigned anesthesiologist in Post Anesthesia Care Unit (PACU) after randomization. The drugs were infused over 10 min through infusion pumps with continuous monitoring. Induction of anesthesia was started soon after the infusion was over by propofol 2 mg/kg, tramadol 100 mg, and atracurium 0.5 mg/kg IV. Laryngoscopy was performed by the primary anesthetist.

Hemodynamic parameters were recorded by the primary anesthetist: before infusion of the study drugs (baseline parameters), after the infusion of the study drug, at laryngoscopy, then one minute, 3 min, 5 min, and 10 min after endotracheal intubation.

The patient was observed during the procedure and postoperatively in the PACU for any complications such as bradycardia, hypotension, cough, bucking, laryngospasm, shivering, and postoperative nausea and vomiting (PONV) and was treated accordingly. A decrease in HR of 20% from baseline in the perioperative period was considered as bradycardia and SBP less than 20% of baseline, or DBP less than 20% of baseline, or both, were considered as hypotension. Patients who had episode of either bradycardia or hypotension were excluded from the study. Bradycardia at any time was treated with 0.6 mg I/V atropine; for PONV, 4 mg ondansetron was administered. In PACU, the patient's sedation and recovery were monitored by the PACU nurse using Ramsay sedation score and Aldrete recovery score at zero minutes (upon arrival in PACU) and at 10 min.

## Statistical analysis

For data analysis, Stata Software Version 16.0 was used. Analysis of demographic data was done using a One-way ANOVA t-test. Comparisons of qualitative data such as sex, ASA physical status and postoperative complications between the groups were conducted using a chi-square ($\chi 2$) test. To assess the effect of three study medications on HR, SBP and DBP over the period of time, multilevel mixed model linear regression was used. Normality assumption was assessed using Kurtosis and Skewness test. Mean Ramsey and Aldrete scores at arrival and after 10 min of arrival among three study groups were assessed using one-way Anova. For pairwise comparison of Ramsey score and Aldrete scores among study groups, Bonferroni test was applied. chi-square ($\chi 2$) test was applied to assess complications among three study groups. For this analysis, cut-off of P-value was kept at 0.05.

 

# 3. RESULTS

All of the ninety patients in three groups were subjected to statistical analysis. None of the patients was excluded (Figure 1).

Socio-demographic data of the participants is presented in Table 1. There were no significant differences in age, weight, gender, and ASA status between the three groups.

There was no significant difference of HR, systolic blood pressure (SBP) and diastolic blood pressure (DBP) among the three study groups (Table 2).

## 2.1. Comparison of HR among three study groups

As compared to dexmedetomidine, there was no significant impact of lidocaine (P = 0.774) and fentanyl (P = 0.992) in managing the HR of patients, while time had a significant impact on the HR (Table 3). Highest drop in HR was observed in dexmedetomidine group after study drug infusion (-25, P = 0.001) and at laryngoscopy (-17.53, P = 0.001). A differential influence of drugs on HR over time was assessed using an interaction term in regression analysis. The interaction between time and treatment was significant and results show that HR is found to be significantly higher in patients who received lidocaine followed by fentanyl. Patients who were given fentanyl had the highest HR after study drug infusion (16.76, P = 0.001) and patients who received lidocaine had the highest HR after 1 min after intubation (24.53, P = 0.001). Overall, dexmedetomidine showed better control in HR than the two other study drugs, which showed inconsistencies in HR over time is shown in Table 4, Figure 2.

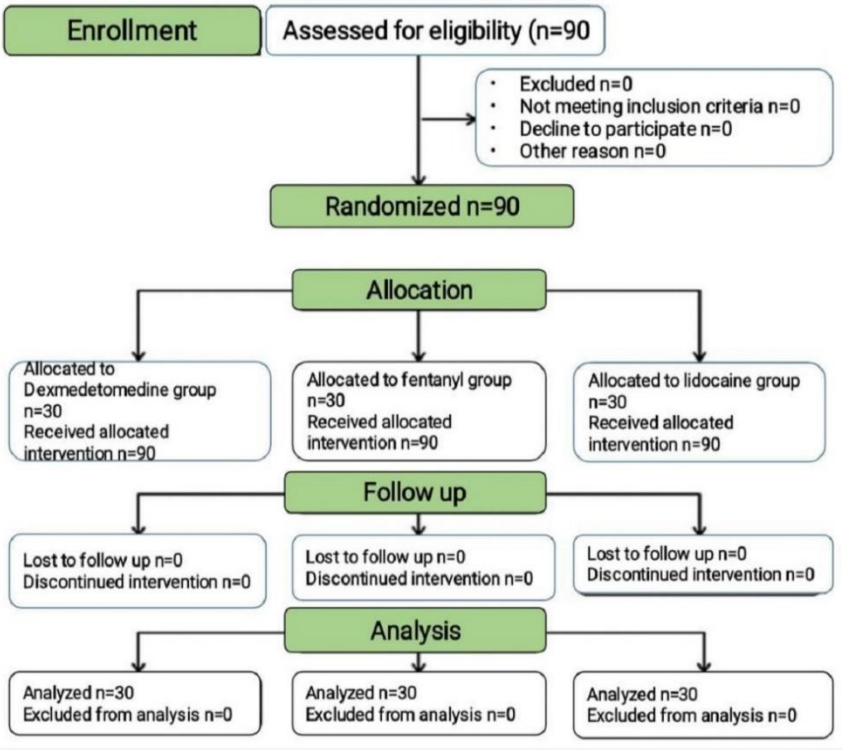


**Figure 1: Consort flow diagram**

**Table 1: Socio-demographic characteristics of participants**

| Patient Characteristics | | Group D (n = 30) | Group F (n = 30) | Group L (n = 30) | Total (n = 90) | Sig. |
|---|---|---|---|---|---|---|
| Age (y) | | 40.6 ± 8.9 | 37.8 ± 11.9 | 39.3 ± 14.31 | 39.2 ± 11.8 | 0.67 |
| Age groups | 20-40 (y) | 14 (46.7) | 14 (46.7) | 14 (46.7) | 42 (46.7) | 1.000 |
| | 41-65 (y) | 16 (53.3) | 16 (53.3) | 16 (53.3) | 48 (53.3) | |
| Weight (kg) | | 74.5 ± 17.7 | 69.4 ± 15.3 | 66.9 ± 10.8 | 70.2 ± 15.1 | 0.141 |
| Weight groups | 40-65 (kg) | 10 (33.3) | 14 (46.7) | 17 (56.7) | 41 (45.6) | 0.191 |
| | 66-110 (kg) | 20 (66.7) | 16 (53.3) | 13 (43.3) | 49 (54.4) | |
| Gender | Men | 12 (40.0) | 11 (36.7) | 6 (20.0) | 29 (32.2) | 0.207 |
| | Women | 18 (60.0) | 19 (63.3) | 24 (80.0) | 61 (67.8) | |
| ASA status | I | 20 (66.7) | 18 (60.0) | 24 (80.0) | 62 (68.9) | 0.234 |
| | II | 10 (33.3) | 12 (40.0) | 6 (20.0) | 28 (31.1) | |

*Data presented as mean ± SD or n (%)*

 

**Table 2: Baseline hemodynamic data of participants**

| Parameter | Group D (n = 30) | Group F (n = 30) | Group L (n = 30) | Sig. |
|---|---|---|---|---|
| Heart rate | 94.57 ± 12.15) | 94.83 ± 23.09) | 94.37 ± 6.31) | 0.993 |
| Systolic Blood Pressure | 131.13 ± 14.02) | 123.17 ± 22.49) | 127.23 ± 16.16) | 0.239 |
| Diastolic Blood Pressure | 86.06 ± 9.67) | 83.53 ± 14.06) | 84.66 ± 10.91) | 0.703 |

**Table 3: Study drug's effect on heart rate (relative to dexmedetomidine)**

| Variable | B (95% CI) | p-value |
|---|---|---|
| Fentanyl | 0.04 (-7.95−8.03) | 0.992 |
| Lidocaine | -1.56 (-9.61−6.49) | 0.774 |

**Table 4: Heart rate variation with the study drugs**

| Time point | B (95% CI) | P-value |
|---|---|---|
| **A. Effect of dexmedetomidine** | | |
| At the end of study drug infusion | -25 (-31.31−-18.68) | 0.001* |
| At laryngoscopy | -17.53 (-23.85−-11.21) | 0.001* |
| 1 min after intubation | -15.26 (-21.58−-8.94) | 0.001* |
| 3 min of intubation | -16.83 (-23.15−-10.51) | 0.001* |
| 5 min after intubation | -15.20 (-21.51−-8.88) | 0.001* |
| 10 min after intubation | -16.53 (-22.85−-10.21) | 0.001* |
| **B. Effect of fentanyl** | | |
| At the end of study drug infusion | 16.76 (7.83−25.70) | 0.001* |
| At laryngoscopy | 8.90 (-0.04−17.83) | 0.050* |
| 1 min after intubation | 9.20 (0.26−18.13) | 0.044* |
| 3 min of intubation | 7.53 (-1.40−16.46) | 0.098 |
| 5 min after intubation | 0.23 (-8.70−9.17) | 0.959 |
| 10 min after intubation | 3.93 (-5.00−12.87) | 0.388 |
| **C. Effect of lidocaine** | | |
| At the end of study drug infusion | 21.53 (12.59−30.46) | 0.001* |
| At laryngoscopy | 21.23 (12.29, 30.16) | 0.001 |
| 1 min after intubation | 24.53 (15.60−33.46) | 0.001* |
| 3 min of intubation | 8.43 (-0.50−17.36) | 0.064 |
| 5 min after intubation | 17.83 (8.89−26.76) | 0.001* |
| 10 min after intubation | 12.20 (3.26−21.12) | 0.007* |
| ** P = 0.05 considered significant* | | |

**Table 5: Study Drug's Effect on Blood Pressure (relative to Dexmedetomidine)**

| Study Drug | SBP | | DBP | |
|---|---|---|---|---|
| | B (95% CI) | P-value | B (95% CI) | P-value |
| Fentanyl | -7.73 (-17.56−2.09) | 0.123 | -1.99 (-9.05−5.06) | 0.58 |
| Lidocaine | -2.51 (-12.34−7.30) | 0.616 | -1.13 (-8.19−5.19) | 0.752 |
| ** P = 0.05 considered significant* | | | | |

 

**Table 6: Effect of study drugs on BP (relative to BP before administration)**

| Time point | SBP | | DBP | |
|---|---|---|---|---|
| | B (95% CI) | P-value | B (95% CI) | P-value |
| **A. Effect of dexmedetomidine** | | | | |
| At the end of study drug infusion | -32.93 (-41.94−-23.92) | 0.001* | -23.63 (-30.01−-17.25) | 0.001* |
| At laryngoscopy | -30.23 (-39.24−-21.22) | 0.001* | -22.96 (-29.34−-16.58) | 0.001* |
| 1 min after intubation | -22.80 (-31.80−-13.79) | 0.001* | -21.56 (-27.94−-15.18) | 0.001* |
| 3 min after intubation | -27.43 (-36.44−-18.42) | 0.001* | -20.66 (-27.04−-14.28) | 0.001* |
| 5 min after intubation | -25.56 (-34.57−-16.55) | 0.001* | -17 (-23.38−-10.61) | 0.001* |
| 10 min after intubation | -21.43 (-30.44−-12.42) | 0.001* | -14.33 (-20.71−-7.95) | 0.001* |
| **B. Effect of lidocaine** | | | | |
| At the end of study drug infusion | 21.53 (12.59−30.46) | 0.001* | 10.70 (1.67−19.72) | 0.020* |
| At laryngoscopy | 33.46 (20.72−46.20) | 0.001* | 26.33 (17.31−35.36) | 0.001* |
| 1 min after intubation | 50.56 (37.82−63.06) | 0.001* | 32.90 (23.87−41.92) | 0.001* |
| 3 min after intubation | 32.23 (19.52−45.01) | 0.001* | 19.06 (10.03−28.09) | 0.001* |
| 5 min after intubation | 36.13 (23.39−48.87) | 0.001* | 19.13 (10.10−28.16) | 0.001* |
| 10 min after intubation | 23.53 (10.79−36.27) | 0.001* | 17.20 (8.17−26.22) | 0.001* |
| **C. Effect of fentanyl** | | | | |
| At the end of study drug infusion | 15.36 (2.62−28.10) | 0.018* | 5.83 (-3.19−14.86) | 0.205 |
| At laryngoscopy | 2.53 (-10.20−15.27) | 0.697 | 0.80 (-8.22−9.82) | 0.862 |
| 1 min after intubation | 25.16 (12.42−37.91) | 0.001* | 17.96 (8.94−26.99) | 0.001* |
| 3 min after intubation | 18.50 (5.75−31.24) | 0.004* | 11.13 (2.10−20.16) | 0.016 |
| 5 min after intubation | 9.4 (-3.34−22.14) | 0.148 | 2.13 (-6.89−11.16) | 0.643 |
| 10 min after intubation | 28.13 (15.39−40.87) | 0.001* | 16.76 (7.74−25.79) | 0.001* |

** P < 0.05 considered significant*

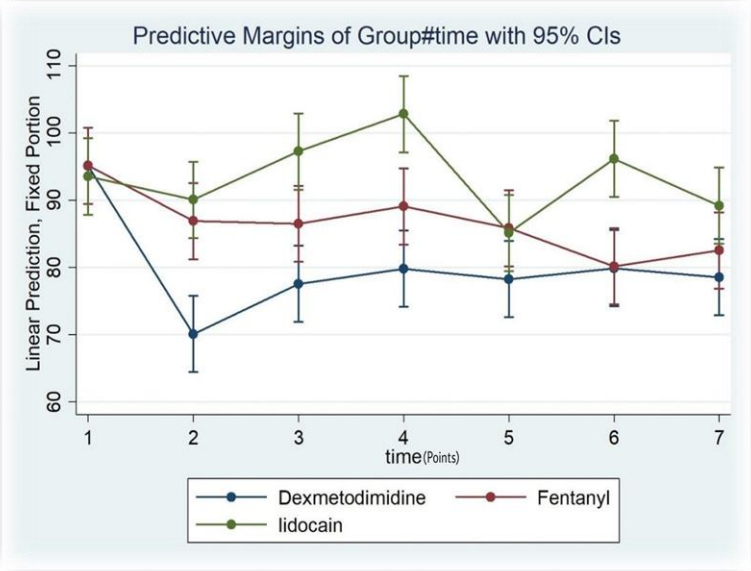


**Figure 2: Comparison of heart rate variations**

## 2.2. Comparison of SBP and DBP among three study groups

In contrast to dexmedetomidine, there was no substantial effect of fentanyl (P = 0.123) or lidocaine (P = 0.616) in managing SBP and no effect of Fentanyl (P = 0.580) or Lidocaine (P = 0.752) in managing DBP (Table 5). Time, on the other hand, has had a big impact on SBP and DBP. Overall, in group D although not clinically significant, SBP dropped the most after study drug infusion (-32.93, P = 0.001) and at intubation time (-30.23, P = 0.001). Also, DBP dropped the most after study drug infusion (-23.63, P = 0.001) and at intubation time (-22.96, P = 0.001). A differential influence of drugs on SBP and DBP over time was assessed using an interaction term in regression analysis. When we investigated the interaction effect, results showed substantial increase in SBP

 

and DBP over time using fentanyl and lidocaine as compared to dexmedetomidine. SBP and DBP were found to be substantially higher in patients who received lidocaine followed by fentanyl. Patients who were given fentanyl and lidocaine had the highest SBP and DBP after 1 min after intubation. Overall, dexmedetomidine showed better results and long-term stability in SBP and DBP than the two other drugs, which showed inconsistencies in SBP over time (Table 6).

In addition, age also had a significant impact on SBP (0.27, P = 0.007) and DBP (0.19, P = 0.004). With every one-year increase in age, SBP was increased by 0.27 mmHg, while DBP increased by 0.19 mmHg. In ASA level 2, mean SBP was significantly higher than ASA level 1 (7.65, P = 0.007) while no association was there between ASA level and DBP as shown in Figure 3 (for SBP) and Figure 4 (for DBP).

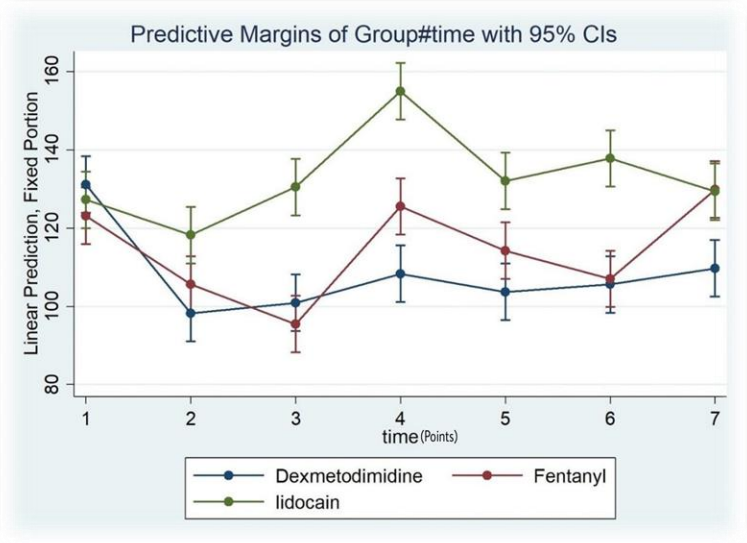


**Figure 3: Comparison of systolic blood pressure variations**

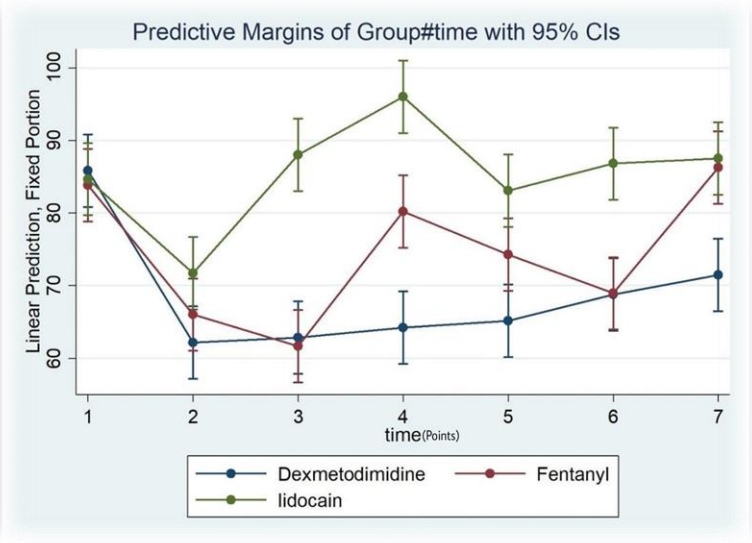


**Figure 4: Comparison of diastolic blood pressure variations**

## 2.3. Effect on Ramsay Sedation Scale (RSS) and Aldrete Sedation Score

Sedation was assessed using RSS at arrival and after 10 min of arrival at post-operative care. At the time of arrival mean RSS score was highest among patients who received dexmedetomidine with mean score of 2.50 ± 0.73. Mean RSS score was significantly different between three study groups (P = 0.001). Bonferroni test was applied for multiple comparisons that showed that mean significant difference of RSS score at the time of arrival is significantly higher in dexmedetomidine than lidocaine (P = 0.001) and fentanyl (P = 0.001). On the other hand, after 10 min of arrival, mean RSS was significantly different (P = 0.008) and highest in dexmedetomidine group (2.06 ± 0.25). On multiple comparisons, significant difference was only found between dexmedetomidine and lidocaine (P = 0.007) Table 7.

Patient's recovery was assessed using Aldrete sedation score at arrival and after 10 min of arrival at post-operative care. Mean Aldrete sedation score was highest in fentanyl group (9.63 ± 0.67) followed by lidocaine and dexmedetomidine as shown in Table 7. Overall, there was a significant difference at the time of arrival (P = 0.001). On multiple comparisons, significant difference of mean Aldrete sedation score was found between dexmedetomidine and fentanyl (P = 0.001). Similarly, Mean Aldrete sedation score was highest in fentanyl group (10 +/-0) after 10 min of arrival and overall difference is significant between three study groups (P = 0.001). Through multiple comparison Aldrete sedation score was higher in fentanyl group as compared to dexmedetomidine and the difference is statistically significant (P = 0.010) Table 7.

## 2.4. Complications / side effects

PONV was reported in one patient in Group D. Hypertension was the most common postoperative complication noted and was found in 19 (21.1%)

 

**Table 7: Comparison of Ramsay and Aldrete sedation scores among three study groups**

| Time | Group D (n = 30) | Group F (n = 30) | Group L (n = 30) | P-value |
|---|---|---|---|---|
| **Ramsay Sedation Scale (RSS)** | | | | |
| At Arrival | 2.50 ± 0.73 | 2.03 ± 0.18 | 1.83 ± 0.38 | 0.001* |
| After 10 Min | 2.06 ± 0.25 | 2.00 ± 0 | 1.86 ± 0.34 | 0.008* |
| **Aldrete Sedation Score** | | | | |
| At Arrival | 8.56 ± 1.47 | 9.63 ± 0.67 | 9.13 ± 0.73 | 0.001* |
| After 10 Min | 9.63 ± 0.72 | 10 ± 0 | 9.83 ± 0.38 | 0.010* |

** P = 0.05 considered significant; Data presented as mean ± SD*

**Table 8: Comparison of complications between the groups**

| Complications | Group D (n = 30) | Group F (n = 30) | Group L (n = 30) | Total | P-value |
|---|---|---|---|---|---|
| Cough | – | 2 (6.7%) | – | 2 (2.2%) | 0.129 |
| Laryngospasm | – | 3 (10.0%) | 4 (13.3%) | 7 (7.8%) | 0.133 |
| Bradycardia | 3 (10.0%) | 1 (3.3%) | – | 4 (4.4%) | 0.16 |
| Regurgitation | – | 1 (3.3%) | – | 1 (1.1%) | 0.384 |
| PONV | 1 (3.3%) | – | – | 1 (1.1%) | 0.424 |
| Hypertension | – | 5 (16.7%) | 14 (46.7%) | 19 (21.1%) | 0.002 |
| Hypotension | 3 (10.0%) | – | – | 5 (5.6%) | 0.227 |

**Significant at P-value = 0.05, Chi-square test applied.*
*Abbreviations: PONV, postoperative nausea and vomiting.*

patients: 14 (46.7%) patients in the lidocaine group and 5 (16.7%) patients in the fentanyl group. No statistically significant difference was found when these complications were compared between the three groups using the chi-square ($\chi 2$) test ($P > 0.05$; Table 8).

# 4. DISCUSSION

The focus of this study was to compare the efficacy of three study drugs (dexmedetomidine, fentanyl and lidocaine) to control the presser response to laryngoscopy and endotracheal intubation during the induction of anesthesia.

In our study, dexmedetomidine showed better control of the stress response associated with laryngoscopy and intubation then other two study drugs, in contrast fentanyl and lidocaine showed inconsistencies in hemodynamics over time. Patel et al. observed that dexmedetomidine significantly attenuates stress response at intubation like our study but they noticed a lesser increase in SBP (6% vs 23%) and HR (10% vs 17%) in comparison to fentanyl respectively.[12] Gandhi et al. used the same dose of 0.6 µg/kg of dexmedetomidine and compared with fentanyl in 100 adult patients. They found a minimal increase in HR, SBP, DBP, and MAP in the dexmedetomidine group, which was consistent with our study.[13] Hariharan et al. and Gupta et al. compared dexmedetomidine with lidocaine and they found that there was marked control in hemodynamic response to intubation in the dexmedetomidine group and better than the combination group.[14,15]

In our study, we noticed a significant decrease in HR after drug administration and at laryngoscopy, in the dexmedetomidine group. These findings are in line with Gogus et al., who compared the effect of dexmedetomidine versus fentanyl on blunting the hemodynamic response to intubation in 90 adult patients. They found that HR was lower at five minutes and 10 min after intubation in the dexmedetomidine group.[16] Saied et al. found a similar result when they compared dexmedetomidine to fentanyl in anesthetizing pediatric patients for cochlear implantation. They started an initial bolus dose of dexmedetomidine 0.4 µg/kg slowly over 10 min, which in contrary to our study was followed by continuous infusion.[17]

Contrary to our study, Jain et al. 2015 found that an infusion of dexmedetomidine at a dose of 1 µg/kg

 

administered over 10 min before induction was equally effective as 2 μg/kg IV fentanyl at induction to attenuate the sympathetic response to laryngoscopy and endotracheal intubation with minimal side effects.[18]

Gurulingappa et al. compared IV fentanyl (4 μg/kg) with lidocaine and placebo (normal saline) in 75 adult patients.[4] They found better results in the fentanyl group, similar to our study.[4] Ahmed et al. compared dexmedetomidine with magnesium sulfate and lidocaine for attenuating stress response to direct laryngoscopy and endotracheal intubation in 56 patients scheduled for abdominal surgery. They observed both dexmedetomidine and magnesium sulfate were equally effective and better than lidocaine.[19]

Like us, other authors have questioned the efficacy of lidocaine in controlling the hemodynamic response to intubation. In studies by Kharwar et al., IV lidocaine 1.5 mg/kg was ineffective in regulating acute hemodynamic response following laryngoscopy and intubation. Lidocaine is one of the cheapest and most readily available drugs, and it is being used in many centers to attenuate stress response to intubation with better results when compared with placebo.[20]

Reddy et al. compared the use of either dexmedetomidine, esmolol, or placebo to attenuate the presser response to laryngoscopy and intubation in 90 adult patients. They found a significant increase in MAP in patients receiving esmolol as compared to dexmedetomidine.[21]

Use of dexmedetomidine is known to produce sedation similar to normal sleep which results in higher perioperative sedation scores and delayed recovery, for this reason dexmedetomidine is being widely used in multiple studies for procedures under MAC.[22-24] The sedation scores were comparable among the groups, but higher sedation scores were found in the dexmedetomidine group in some patients. Patel et al. also concluded that postoperatively dexmedetomidine demonstrates significantly high sedation than the fentanyl and lidocaine groups; hence, the delayed recovery.[12] A study conducted by Menshawi et al. 2019 found no difference among time of recovery between dexmedetomidine and lidocaine although delayed recovery was observed with dexmedetomidine when compared with fentanyl in patients undergoing general anesthesia for elective gynecological procedures.[25]

In concordance with our results, Kamel et al. concluded that dexmedetomidine sedation delayed postoperative recovery in comparison to opioid based sedation.[24]

Dexmedetomidine, an α-2 antagonist, can cause a significant decrease in HR and SBP. In our study, three patients experienced bradycardia and five patients had hypotension in Group D but were clinically did not require treatment. Forty-six percent of patients experienced hypertension in Group L. Similar conclusions were seen by other researchers in their studies. In some patients, there was a highly significant decrease in heart rate ($P < 0.001$) and blood pressure, requiring intervention.[15,19,20]

# 5. LIMITATIONS

This current study was not without some limitations. This was a single-centered study that incorporated a small sample size and a single type of surgery. The conclusive markers of stress reaction were serum catecholamine levels, which could not be measured in this investigation due to inaccessibility.

# 6. CONCLUSION

Dexmedetomidine gives better control of hemodynamic parameters during laryngoscopy and intubation than both fentanyl and lidocaine. Patients received dexmedetomidine exhibited higher sedation scores at arrival in PACU but it became equivalent in all three groups at 10 min. Patients in the fentanyl group showed early attainment of Aldrete sedation score, hence, meeting discharge criteria more quickly than the dexmedetomidine and lidocaine groups. Hypertension was observed more in the lidocaine group; however, bradycardia, hypotension, and PONV were more pronounced in the dexmedetomidine group, although the findings were not statistically significant.

## 7. Data availability

The numerical data generated during this research is available with the authors.

## 8. Acknowledgement

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## 9. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

## 10. Authors' contribution

SU: Concept, study design, conduction of study, manuscript writing

HJ: Acquisition, resources, analysis, data collection, processing, manuscript writing

SA: Analysis and interpretation of manuscript and critical review

AM: Resources, materials and literature search

AN, RJ: Analysis and interpretation of literature and critical review

 

SJS: Resources, data collection and processing

SZS: Final approval of manuscript and critical review

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