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Comparison of Dexmedetomidine with Fentanyl for Attenuation of Hemodynamic Response to Laryngoscopy and Tracheal Intubation

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ABSTRACT

Background

Laryngoscopy and tracheal intubation (LTI) often lead to an undesirable increase in arterial blood pressure (BP) and heart rate (HR). The hemodynamic response is exaggerated in hypertensive patients even though rendered normotensive pre-operatively by antihypertensive medication. Dexmedetomidine is an alpha-2 adrenoreceptor agonist with sympatholytic, sedative, anxiolytic effects. Fentanyl citrate is a synthetic phenyl piperidine opioid agonist that is structurally related to meperidine.

Aim

The present study assesses whether a single pre-induction dose of intravenous dexmedetomidine or fentanyl is more efficient in attenuating HD response to laryngoscopy and tracheal intubation.

Methods

This randomized study was conducted at a tertiary care centre among 100 patients scheduled for various surgeries under general anaesthesia. The study was done from January 2022 to June 2022. Patients were randomized into groups A and B, each group containing 50 patients. Patients aged above 18 years,

with ASA grade I and II, either gender were included. Parameters like age, gender, ASA grade, hemodynamic parameters like heart rate, systolic blood pressure, diastolic blood pressure and adverse effects were assessed.

Results

There is no significant difference in the mean age of patients. Most of the patients were females and most of patients belonged to ASA grade I. Hemodynamic response attenuation was seen with both drugs but more significant reduction was seen in group A patients. Pruritus was the most common side effect seen.

Conclusion

Both dexmedetomidine and Fentanyl were able to attenuate the undesirable hemodynamic responses to laryngoscopy and tracheal intubation, but dexmedetomidine at a dose of 1 mcg/kg has a better profile for attenuating the pressor response than Fentanyl (2 mcg/kg).

Keywords

Dexmedetomidine, Fentanyl, Hemodynamic response, pressor response, Tracheal intubation.

INTRODUCTION

Laryngoscopy and tracheal intubation (LTI) often lead to an undesirable increase in arterial blood pressure (BP) and heart rate (HR)[1]. The magnitude of hemodynamic changes observed may be dependent on various factors like depth of anaesthesia, use of drugs before airway manipulation, the anaesthetic agent used, and duration of LTI. To date, the exact mechanism of hemodynamic responses to LTI has not been clarified. The proposed mechanism for the perturbed hemodynamic response during LTI is short-lasting sympathoneuroendocrine stimulation. [2-4] There is an unpredictable, transient, variable increase in BP and HR. Transitory hypertension and tachycardia cause no risk in healthy individuals. But they may be hazardous to those with hypertension, myocardial ischemia, or cerebrovascular disease [(4)] and may predispose such individuals to the development of pulmonary edema, myocardial ischemia, and cerebrovascular accident.[5]

The hemodynamic response is exaggerated in hypertensive patients even though rendered normotensive pre-operatively by antihypertensive medication. 6 Hemodynamic (HD) response may result in intra-operative myocardial infarction, acute left ventricular failure (LVF)7 and intracranial bleed in individuals with end-organ decompensation.

Intravenous anaesthetic induction agents do not adequately or predictably suppress the HD responses induced by LTI. So before initiating laryngoscopy, additional pharmacological measures like the use of volatile anaesthetics,8 topical and intravenous lidocaine,[9-10] opioids,[11- 13] vasodilators[14,15] calcium channel blockers[16-18] and β-blockers[19-21] have been tried by various investigators.

Alpha 2-agonists are assuming greater importance as anaesthetic adjuvants and analgesics. Their primary effect is sympatholytic. Initially, they have been used as antihypertensive drugs, but applications based on their sedative, anxiolytic, and analgesic properties are being developed.

Dexmedetomidine is an alpha-2 adrenoreceptor agonist with sympatholytic, sedative, anxiolytic, anaesthetic sparing, and hemodynamic stabilizing properties without significant respiratory depression.

Fentanyl citrate is a synthetic phenyl piperidine opioid agonist that is structurally related to meperidine. As an analgesic, it is 75- 125 times more potent than morphine. Fentanyl is primarily a Mu receptor agonist

at the supraspinal site with an analgesic potency greater than morphine, pethidine, and alfentanil.

AIM

The present study assesses whether a single pre-induction dose of intravenous dexmedetomidine or fentanyl is more efficient in attenuating HD response to laryngoscopy and tracheal intubation.

MATERIALS AND METHODS

Source of data: This comparative randomized study was done on patients scheduled for elective surgeries under general anaesthesia at a tertiary care centre named Great Eastern Medical School & hospital, Srikakulam, Andhra Pradesh, from January 2022 to June 2022.

Inclusion Criteria

- Patients aged above 18 years
- Either gender
- Females with ASA grade I and II
- Patients scheduled for various surgeries
- Under general anaesthesia- electively Patients who provided informed consent
- To participate in the study.

Exclusion Criteria

- Patients with BMI more than 35kg/m2. Pregnant and lactating women
- Patients with allergy to dexmedetomidine or fentanyl
- Patient with a history of cerebrovascular, neurological, cardiovascular, pulmonary or, metabolic disease.
- Predicted difficult intubation (Mallampati class III and IV)
- History of neuromuscular disease that would make muscle relaxants contraindicated.
- Heart rate<50/min and basal BP outside the 100/50- 160/110 mmHg range.

Sampling: Simple Random sampling is used.

Sample Size Calculation

As per the previous study,22 the standard deviation of BP was 10.12mm of Hg for dexmedetomidine at baseline, at a confidence interval of 90%, with 2% error, the minimum sample size came to be 87. So, we included 100 patients in our study.

Parameters Assessed

- Age
- Gender
- ASA grade
- Hemodynamic parameters- systolic
- blood pressure (SBP), diastolic blood pressure (DBP), HR
- Adverse effects

GROUPS

100 patients were divided into two groups by randomization using computer-generated software.

Group [A]: 50 patients received injection dexmedetomidine as a bolus dose of 1 mcg/kg diluted to a total volume of 10 milliliters with normal saline (0.9%).

Group [B]: 50 patients received 2mcg /kg fentanyl diluted to a total volume of 10 milliliters with normal saline.

TECHNIQUE

IV cannula 18G was secured. All subjects were preloaded with 10ml/kg of Ringer lactate solution. Baseline hemodynamic parameters were noted after applying standard monitors (pulse oximetry, NIBP, ECG leads) that include Heart rate, Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP). Preoxygenation was done with 100% oxygen. Anaesthesia was induced

intravenously by midazolam (0.04mg/kg), propofol 2mg/kg, induction was confirmed by observing the loss of eyelash reflex. This was followed by intravenous vecuronium (0.12mg/kg) to facilitate intubation. Three minutes later, laryngoscopy was performed by a qualified anaesthesiologist using the laryngoscope. Patient was intubated and after confirmation was done with 5-point auscultation. The tube was secured and connected to ventilator and maintained on oxygen and air (50:50). Hemodynamic parameters were monitored that include HR, SBP, DBP at 1,3 ,5 ,10 ,15 ,30 minutes after laryngoscopy and tracheal intubation respectively. During the period of observation, other stimulations were given like bladder catheterization, nasogastric tube insertion, change in position, or surgical incision.

STATISTICAL ANALYSIS

Data analysis was done using Epi info version 7.2.5. The results were expressed as mean ± S.D, percentages, and numerical parameters were compared using students t-test between patients of two groups. Categorical parameters were compared using chi square test. P value < 0.05 was considered significant.

ETHICAL CONSIDERATIONS

Institutional ethics committee approval was taken before conducting the study. Informed consent form was taken from every subject who participated in the study.

RESULTS

Age

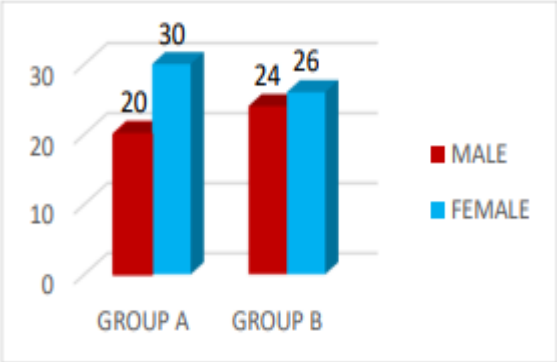
There is no significant difference in the mean age of patients of both groups as per t test(p=0.95). Table 1 illustrates mean age of patients in both groups

PARAMETERS	GROUP A (n=50)	GROUP B (n=50)	p-VALUE
AGE(YRS)	38.4± 10.62	40.5± 9.95	0.3192

Gender

Most of the patients were females in our study.

Graph 1 shows gender distribution

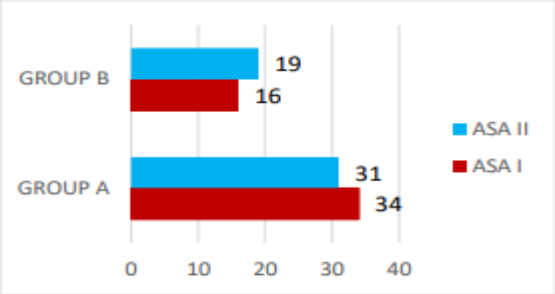


ASA Grade

Most of the patients belonged to ASA grade I.

Graph 2 shows ASA grade.

Graph 2 shows ASA grade of patients



HEART RATE

Heart rate recorded at 5 minutes, 10 minutes and 15 min. after LTI were statistically significant. It was less in group A patients.

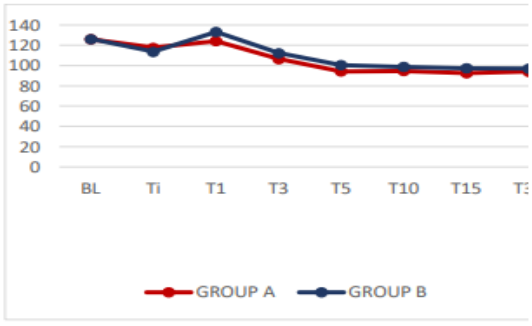
Table 2 shows heart rate in various intervals

Parameters	GROUP A	GROUP B	p-VALUE
BASELINE	79.58±12.68	75.82 ±14.89	0.1772
1 min	81± 15.72	82.86 ±16.05	0.055
3 min	72.10± 15.79	74.42 ±14.58	0.4471
5 min	67.04± 13.70	72.74 ±12.03	0.029
10 min	66.94± 12.72	71.58± 10.26	0.04
15 min	64.40 ±12.85	69.78± 9.95	0.02
30 min	65.50 ±12.82	68.96± 9.94	0.14

Systolic Blood Pressure

SBP recorded at 1, 3, 5, 10, 15, and 30 minutes after LTI were significant statistically. They were 0 10 20 30 GROUP A GROUP B 20 24 30 26 MALE FEMALE 34 16 31 19 0 10 20 30 40 GROUP A GROUP B ASA II ASA I less in group A patients compared to group B patients. (P=0.0001) at all intervals.

Graph 3 shows line diagram of SBP. Graph 3 shows line diagram of SBP



Diastolic Blood Pressure

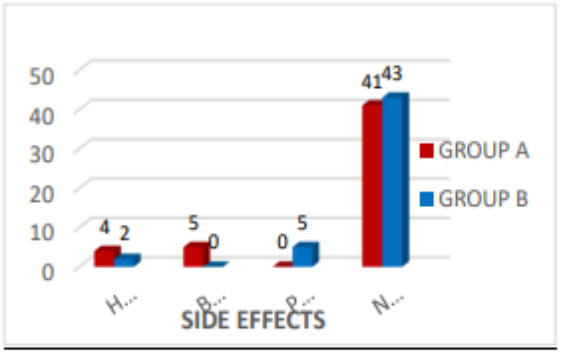
In this study diastolic blood pressure recorded at 1, 3, 5, 10, 15, and 30 minutes after LTI were statistically significant. It was less in group A patients.

Table 3 shows DBP at various intervals

Parameters	Group A	Group B	P - Value
Baseline	79.00 ±10.0	76.60 ±6.91	0.1673
1 min	68.68 ±9.12	72.78±10.69	0.0417
3 min	61.58 ±10.06	68.44 ±13.98	0.0059
5 min	54.53 ±7.34	59.78 ±11.41	0.0070
10 min	54.46 ±7.39	59.54 ±9.67	0.0040
15 min	54.5 ±7.27	58.38 ±9.57	0.0254
30 min	56.5±5.01	59.54 ±9.67	0.0236

ADVERSE EFFECTS

Pruritus is the most common side effect seen. Graph 4 shows adverse effects.



DISCUSSION

In the current study 100 patients were included. There is no significant difference in the mean age of patients. Most of the patients were females and most of patients belonged to ASA grade I. Hemodynamic response attenuation was seen with both drugs but more significant reduction was seen in group A patients. Pruritus was the most common side effect seen.

Syafri Kamsul et al23 in their study, found the incidence of side effects of hypertension and tachycardia. In the fentanyl group, 5 patients (20.83%) had hypertension, and 5 patients (20.83%) experienced tachycardia. In contrast to 0 20 40 60 80 100 120 140 BL Ti T1 T3 T5 T10 T15 T30 GROUP A GROUP B 0 10 20 30 40 50 4 5 0 41 2 0 5 43 SIDE EFFECTS GROUP A GROUP B the above study, no hypertension and tachycardia were reported in the present study.

In a study conducted by **Kharwar et al**.[24] hypotension (systolic blood pressure <90 mmHg) was observed in three patients of the dexmedetomidine group that received a dose of 1 mcg/kg intraoperatively. In two patients, hypotension was corrected by giving intravenous fluids, and in one patient intravenous Inj.

Mephentermine 6mg was given along with rapid fluid infusion. No such episode was observed in the fentanyl group. In the present study, hypotension was treated by a rapid bolus of iv fluids. Two of 6 patients with hypotension in both groups were treated with Inj Ephedrine 6mg IV.

Srinivas et al.[25] in their study showed that both Dexmedetomidine and Fentanyl groups showed attenuation of the rise in the MAP and were significant as compared to that in the control group similar to our study. In the study conducted by **Sagar Gandhi et al.**[26] it was observed that the DBP was significantly increased from the baseline during laryngoscopy and after intubation in both the study groups and returned to baseline at the end of 10 minutes post-intubation in all the Group when 0.6 µg/kg dexmedetomidine was given as IV premedication and Fentanyl 2 µ/kg, which was not in concordance to the present study where there was significant attenuation in diastolic blood pressure when dexmedetomidine of 1µ/kg was used.

CONCLUSION

It is concluded that both dexmedetomidine and Fentanyl were able to attenuate the undesirable hemodynamic responses to laryngoscopy and tracheal intubation, but dexmedetomidine at a dose of 1 mcg/kg has a better profile for attenuating the pressor response than Fentanyl (2 mcg/kg).

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