Comparison of Dexmedetomidine and Fentanyl for Blunting Hemodynamic Response to Intubation

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ABSTRACT

Objective: To compare the effects of Dexmedetomidine and Fentanyl on the blunting of the hemodynamic response to intubation.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Combined Military Hospital Peshawar Pakistan, from Jan to Aug 2021.

Methodology: This study was conducted on 908 patients who were ASA grades I and II and underwent general anaesthesia for any surgical procedure. Group-A received Dexmedetomidine, while Group-B received Fentanyl and routine pre-anaesthetic medications. Hemodynamic responses in both groups were recorded and compared in heart rate and mean arterial pressure at baseline, 2, 5, and 10 minutes after the intubation.

Results: Out of 908 patients equally divided into two groups, 579 (63.7%) were males, while 329 (36.3%) were females. The mean age of patients included in our study was 33.445 6.363 years. A significant increase in heart rate was found at 2, 5 and 10 minutes in the group who took Fentanyl compared to the group who took Dexmedetomidine (*p*-value 0.001). Significant increases in mean arterial pressure were found at 2 and 5 minutes (*p*-value 0.019 and 0.007, respectively) in the Fentanyl-group, while no significant difference was found at 10 minutes in either group (*p*-value 0.914).

Conclusion: In this study, Dexmedetomidine was found to be a better agent in providing hemodynamic stability during and after the process of intubation compared to Fentanyl.

Keywords: Dexmedetomidine, Fentanyl, Heart rate, Intubation, Mean arterial pressure.

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INTRODUCTION

Anaesthetists across the globe have been trying various agents to attenuate the hemodynamic response associated with intubation during the administration of general anaesthesia.[1,2,3] In 2020, a study was conducted in Iran comparing the roles of Dexmede-tomidine, Lidocaine, and Fentanyl for attenuating the hemodynamic response associated with intubation.[4] They concluded that Fentanyl was a better option than Dexmedetomidine, which was not suitable as it led to hypotension and bradycardia. Another study from Turkey regarding the effects of Dexmedetomidine on hemodynamic responses among patients undergoing craniotomies, revealed that dexmedetomidine infusion effectively prevented adverse hemodynamic responses in patients undergoing craniotomies.[5] Another study found that intravenous and intranasal routes were equally effective in this regard.[6]

Patients undergoing general anaesthesia for any surgical procedure may have certain comorbid conditions which may otherwise predispose them to various complications.[7] Anaesthetists, throughout the procedure, need to monitor the vital signs of patients, especially on occasions that have been associated with rapid changes in hemodynamic parameters like laryngoscopy and intubation.[8,9] A local study concluded that systolic, diastolic, and mean blood pressure responses were altered after intubation and that it was seen more in patients suffering from diabetes mellitus.[10] Limited local data has been available regarding the role of various medications to attenuate the hemodynamic response on this occasion. We, therefore, planned this study with the rationale of comparing the effects of Dexmedetomidine and Fentanyl on the blunting of hemodynamic response to intubation.

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METHODOLOGY

This comparative cross-sectional study was conducted at the Anaesthesia Department of the Combined Military Hospital, Peshawar from January 2021 to August 2021. The sample size was calculated by the WHO sample size calculator by using the population proportion of the increase in HR with the use of Dexmedetomidine as 5%.[11] A non-probability

consecutive sampling technique was used to gather the sample, and then all the patients were equally randomised into two groups via the block randomisation method.

Inclusion Criteria: All patients between 18 and 65 years who were classified as ASA grades I and II undergoing any surgical procedure were included in the study.

Exclusion Criteria: Patients with known allergies to any of the medications used in the study or those with unstable hemodynamic parameters before anaesthesia were excluded. Patients undergoing cardiothoracic surgeries were also not included in the study.

After ethical approval from the Ethical Review Board Committee (IREB Letter No. 246) and written informed consent from potential participants, patients who fulfilled the inclusion criteria were included. Both groups received the usual pre-anaesthetic medications.[12] In addition to routine pre-anaesthetic medications, Group-A received 1 g/kg of Dexmede-tomidine as an intravenous (IV) infusion, while Group-B received an intravenous 2 g/kg of Fentanyl.[13,14] Heart rate and mean arterial pressure were measured in both groups at baseline, 2, and 10 minutes after the intubation. The clinician who assessed the hemodynamic parameters was blind to the facts regarding the type of medication administered to the patient.

All statistical analysis was performed using the Statistics Package for Social Sciences version 24.0 (SPSS-24.0). Frequency and percentages were calculated for qualitative variables, while mean and standard deviation were calculated for quantitative variables. The paired t-test was applied to look for a statistically significant difference in the hemodynamic parameters at baseline,[2,5] and 10 minutes after the intubation. The *p*-values less than or equal to 0.05 were taken as significant for the t-test.

RESULTS

A total of 908 patients who underwent general anaesthesia for various surgical procedures were included in the study. Out of 908 patients, equally divided into two groups, 579 (63.7%) were males, while 329 (36.3%) were females. The mean age of patients included in our study was 33.445 6.363 years. Table-I showed the general characteristics of study participants. Out of 454 (50%) received Dexmedetomidine, while a similar number of patients received Fentanyl. In our study, 505 (55.7%) were ASA I, while 402 (44.3%) were ASA II in our study.

Table-I: Characteristics of study participants.

Parameters	n(%)
Age (Years)	
Mean ± SD	33.445 ±6.363 years
Range (Min-Max)	20 years - 59 years
Gender	
Male	579 (63.7%)
Female	329 (36.3%)
Treatment Options	
Group A (Dexmedetomidine)	454 (50%)
Group B (Fentanyl)	454 (50%)
American Society of Anesthesiology Grading	
Grade I	506 (55.7%)
Grade II	402 (44.3%)

Table-II showed a significant increase in heart rate at 2, 5, and 10 minutes in the group who took Fentanyl as compared to the group who took Dexmedetomidine (*p*-value 0.001). Mean arterial pressure was also not statistically different in both the groups at the baseline (Table-III).

Table-II: Comparison of Heart rate at baseline, 2, 5 and 10 minutes' post intubation.

Time	Group A (Mean ± Standard Deviation)	Group B (Mean ± Standard Deviation)	*p*-value
Baseline	72.114 ± 4.993	72.052 ± 5.168	0.742
2 (Minutes)	72.618 ± 5.340	79..907 ± 6.879	<0.001
5 (Minutes)	73.103 ± 4.963	80.660 ± 6.683	<0.001
10 (Minutes)	72.757 ± 5.305	79.713 ± 7.317	<0.001

Table-III: Comparison of Mean Arterial pressure at baseline, 2, 5 and 10 minutes' post intubation.

Time	Group A Mean ± standard deviation	Group B Mean ± standard deviation	*p*-value
Baseline	90.544 ± 4.782	90.744 ± 4.869	0.510
2 (Minutes)	90.630 ± 5.064	91..019 ± 4.901	0.019
5 (Minutes)	90.931 ± 4.994	91.596 ± 4.887	0.007
10 (Minutes)	90.680 ± 4.557	90.711 ± 4.519	0.914

It was summarised that a statistically significant increase in mean arterial pressure was found at 2 and 5 minutes (*p*-value 0.019 and 0.007, respectively) in the Fentanyl group, while no significant difference was found at 10 minutes in either group (*p*-value 0.914).

DISCUSSION

In our study, Fentanyl was found to be less effective than Dexmedetomidine in providing hemodynamic stability. To face various challenges during surgical procedures, from pre-anaesthesia workup before the surgery to the patient's post-surgical recovery. The

real challenge starts with the induction of general anaesthesia, and closed eyes need to be kept on all the patient's vital signs. Intubation is when a strong sympathetic response is generated in the body, and hemodynamic instability may occur, leading to severe consequences in vulnerable patients. Multiple pharmacological agents have been used to attenuate this sympathetic response, but limited data has been generated regarding a newer agent, Dexmedetomidine. We, therefore, conducted this study in our tertiary care hospital to compare the effects of Dexmedetomidine and Fentanyl on the blunting of hemodynamic response to intubation.

A previous study in 2016 was conducted on a set of patients in Egypt comparing the effectiveness of labetalol and Dexmedetomidine for attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation.[15] They concluded that Dexmedetomidine was better in attenuating the response in terms of mean arterial pressure and heart rate than labetalol and normal saline. In addition, there were no serious adverse effects noted with Dexmedetomidine either in their study population. We did not compare Dexmedetomidine with labetalol or normal saline, but when compared with intravenous Fentanyl, Dexmedetomidine emerged as a better option for attenuation of hemodynamic response after intubation.

A similar study was performed in 2014 in Portugal by Gogus *et al*,[16] comparing Dexmedetomidine, Fentanyl, and Esmolol to prevent hemodynamic changes after intubation during the induction of general anaesthesia. They revealed that Dexmedeto-midine effectively stabilised the heart rate while Esmolol was better at stabilising the systolic, diastolic and mean arterial pressure after intubation. In our data set, we observed a significant increase in heart rate at 2,5 and 10 minutes in the group who took Fentanyl as compared to the group who took Dexmedetomidine (*p*-value 0.001). Significant increases in mean arterial pressure were found at 2 and 5 minutes (*p*-value 0.019 and 0.007, respectively) in the Fentanyl group, while no significant difference was found at 10 minutes in either group (*p*-value 0.914).

Rajan *et al*,[17] compared the heart rate and blood pressure changes and other clinical parameters that accompany awake fiberoptic intubation following sedation with Dexmedetomidine and Fentanyl. The results of their study showed that except at 1 min post-intubation, where Dexmedetomidine showed better results, no significant change in heart rate or blood pressure was observed in either group. They otherwise recommended the use of Dexmedetomidine because of enhanced patient comfort as compared to Fentanyl. We also compared the same two medications, but our study showed that Dexmedetomidine was statistically significantly superior in attenuating heart rate at 2, 5, and 10 minutes and mean arterial pressure at 2 and 5 minutes.

An Indian study by Ahad *et al*,[18] compared the combination of midazolam with Fentanyl and Dexmedetomidine for sedation and safety. They concluded that post-intubation heart rate and diastolic blood pressure were statistically signi-ficantly better attenuated in patients taking Dexmede-tomidine than a combination of Midazolam and Fentanyl. Our results supported the results generated by Ahad *et al*, on a similar set of populations across the border.

Hemodynamic response stability is of utmost importance during intubation, and it was found to be better achieved with Dexmedetomidine as compared to Fentanyl in our data set.

LIMITATIONS OF STUDY

This study had a few limitations. Standardisation of anaesthesia drugs was not done. The incidence of any long-term complications or adverse effects in both groups was not ascertained, and the relative safety of both options remains questionable after this study. Future studies addressing these limitations can generate generalizable results for our population.

CONCLUSION

In this study, Dexmedetomidine was found to be a better agent in providing hemodynamic stability during and after the process of intubation compared to Fentanyl.

Conflict of Interest: None.

Authors' Contribution

AK: Principal investigator, conception design, data collection, analysis, interpretation of data, SHF: Supervisor, intellectual contribution, analysis, revising, interpretation, SI: Data analysis, design, interpretation, intellectual contribution, ZK:, TY:, SK:, Intellectual contribution.

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