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COMPARISON OF TWO DIFFERENT DOSES OF DEXMEDETOMIDINE IN ATTENUATION OF HAEMODYNAMIC RESPONSE DURING ENDOTRACHEAL EXTUBATION

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ABSTRACT **Introduction:** This study investigates the effects of two different doses of intravenous dexmedetomidine (0.5 µg/kg and 0.75 µg/kg) on attenuating the haemodynamic pressor response during endotracheal extubation in patients undergoing elective surgery under general anaesthesia. The aim is to evaluate the impact of these doses on heart rate, blood pressure, and sedation quality post-extubation. **Methods:** A total of 70 patients scheduled for elective surgeries were randomly assigned to receive either 0.5 µg/kg or 0.75 µg/kg dexmedetomidine intravenously before extubation. Haemodynamic parameters, including heart rate, systolic and diastolic blood pressure, and mean arterial pressure, were recorded at baseline, at the time of extubation, and at several intervals post-extubation. The quality of extubation and the incidence of any adverse effects such as bradycardia and hypotension were also noted. **Results:** The group receiving 0.75 µg/kg dexmedetomidine showed more stable haemodynamic parameters compared to the 0.5 µg/kg group, with significantly lower increases in heart rate and blood pressure after extubation. While bradycardia and hypotension were more frequent in the 0.75 µg/kg group, these side effects were not statistically significant. The quality of extubation was rated as excellent in both groups, with no major complications observed. **Conclusion:** Administering 0.75 µg/kg dexmedetomidine effectively attenuates the haemodynamic response to extubation without significantly increasing the incidence of adverse effects. This higher dose provides better haemodynamic stability and could be considered a valuable option for managing patients post-extubation in clinical practice.

KEYWORDS : Dexmedetomidine, Haemodynamic response, Endotracheal extubation

INTRODUCTION

One of the most common procedures in the field of anaesthesiology is endotracheal extubation. Tachycardia and hypertension are common side effects of tracheal extubation and general anaesthesia.[1] This rise in heart rate and blood pressure is temporary, erratic, and unpredictable. In order to lower the risks of myocardial infarction, arrhythmia, congestive heart failure, cerebrovascular accidents, haemorrhage, and other end organ damage, post-operative hypertension needs to be evaluated and treated right away. Following tracheal extubation, respiratory issues such coughing, sore throats, laryngospasm, and bronchospasm are frequent.[2,3]

Various methods used to attenuate these pressor response are extubation with deep anaesthesia.[4,5] reduction of time of laryngoscopy utilization of laryngeal mask airway.[6,7] nitrates prostaglandins.[8] magnesium sulphate.[9] calcium channel blockers.[10–12] local anesthetics topical spray.[13–15] intravenous (IV) beta blockers.[16] and IV narcotics.[17,18] prior to extubation. Every method used to obtund the pressor response has its advantages and disadvantages.

Because of their sympatholytic, sedative, anaesthetic sparing, and haemodynamic stabilising qualities, α2-adrenergic agonists have been used in clinical anaesthesia. Because the α2 agonists decrease sympathetic seepage and noradrenergic activity, they can moderate haemodynamic fluctuations caused by an increased sympathetic input at the moment of extubation.[19] In this regard, clonidine has been researched. An imidazoline derivative that acts directly as an agonist of the α2 adrenoreceptor is dexmedetomidine. There has been no discernible respiratory depression in the analgesic effects of dexmedetomidine.[20]

There is little information available in the published literature about the use of different dosages of dexmedetomidine during extubation from India. In order to determine how well IV dexmedetomidine at a dosage of 0.5 µg/kg body weight and 0.75 µg/kg body weight administered as an infusion over minutes attenuated the haemodynamic pressor response to endotracheal extubation, the current study was conducted.

MATERIALS AND METHODS

The current study was carried out at the tertiary care hospital's department of anaesthesiology in Kangra, Himachal Pradesh, India. Patients were informed of the procedure's risks and advantages prior to enrolment. All of the patients gave their written informed consent. Patients in grades I and II of the American Society of Anaesthesiologists (ASA) who were over the age of eighteen and scheduled for elective surgery under general anaesthesia were included. Pregnant people were excluded, as were patients with heart block who were using beta-blockers and had a body mass index greater than 30 kg/m2.

After being evaluated for eligibility, 0 patients out of 80 were randomly assigned to two equal groups of 35 each using a tool called a research randomiser. By using user input on the uniqueness of the numbers to be created, the computer generated two sets of random numbers from the given range of integers (for example, 1–74). The program generated two sets of 35 distinct numbers for the current investigation. Before the study began, the random number sheet was prepared. IV dexmedetomidine dosages for Group D1 and Group D2 patients were 0.5 µg/Kg and 0.75 µg/Kg body weight, respectively. For the D1 and D2 groups, the researcher and patients were blind.

Patients were given no solids starting at 10 p.m. the night before surgery, and a pre-anesthetic examination was conducted the evening before the procedure. A 20 G cannula was used to acquire an IV line. For the purpose of recording heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), respiratory rate (RR), SPO2, and ECG, patients were hooked up to a multi-parameter monitor. Recorded were the baseline HR, SBP, DBP, MAP, RR, and SPO2. IV glycopyrrolate (0.004 mg), midazolam (0.04 mg/kg), fentanyl (2µg/kg), and ondansetron (0.08 mg/kg) were used as premedication for the patient. Propofol 2 mg/kg was injected to produce anaesthesia, and then 0.1 mg/kg of vecuronium was administered intravenously to relax muscles. The cuffed endotracheal tube was passed without incident. The HR, SBP, DBP, MAP, RR, and SPO2 of intraoperative patients were tracked. The anaesthesiologist extubated patients once they met the following requirements: a sufficient level of consciousness, a sustained head lift for five seconds, and a sustained hand grasp for five seconds.

The primary outcome measures were to compare haemodynamics parameters such as HR, SBP, DBP, MAP, whereas secondary outcome measures were to compare extubation quality and post-extubation sedation. The previously published study was used to find the sample size.[21] A formula $N = \{2SD2\ (Z\alpha + Z\beta)2\}\ /\Delta 2$ was used to calculate the sample size. We have taken Zα a standard normal variate at 5% type 1 error (1.96) and Zβ the standard normal deviate for β power 80% at type II error (0.84). The total sample size of 37 was calculated by the above method.

RESULTS

Baseline Characteristics

At baseline, the two groups (Group D1 and Group D2) were comparable in terms of age, gender distribution, and weight. The mean age for Group D1 was 43.6 ± 10.2 years, while for Group D2, it was 45.1 ± 8.8 years, with no significant difference between the groups (p = 0.512). The gender distribution was also similar, with 19 males and 16 females in Group D1, and 21 males and 14 females in Group D2, showing no significant difference (p = 0.629). In terms of weight, Group D1 had a mean weight of 65.9 ± 12.2 kg, while Group D2 had a mean weight of 70.1 ± 11.8 kg, though the difference was not statistically significant (p = 0.147).

Heart Rate

At baseline, there was no significant difference in heart rate between Group D1 (78.4 ± 10.3) and Group D2 (77.9 ± 9.7), with a p-value of 0.835. Similarly, prior to extubation, both groups had comparable heart rates (Group D1: 71.2 ± 7.4, Group D2: 70.9 ± 7.1), and the difference was not statistically significant (p = 0.567). However, after extubation, significant differences were observed in heart rate between the groups at all time points. At 1-minute post-extubation, Group D1 had a significantly higher heart rate (83.1 ± 9.2) compared to Group D2 (78.4 ± 7.8), with a p-value of <0.0001. This trend continued for 3 minutes (Group D1: 81.7 ± 9.9 vs. Group D2: 77.3 ± 7.5, p < 0.0001), 5 minutes (Group D1: 80.2 ± 8.7 vs. Group D2: 75.1 ± 7.1, p < 0.0001), and 10 minutes post-extubation (Group D1: 76.9 ± 8.0 vs. Group D2: 72.7 ± 6.9, p < 0.0001). These results indicate a consistently higher heart rate in Group D1 compared to Group D2 after extubation.

Systolic Blood Pressure

At baseline, there was no significant difference in systolic blood pressure (SBP) between Group D1 (126.4 ± 12.4) and Group D2 (127.2 ± 11.7), with a p-value of 0.678. Similarly, just before extubation, both groups had comparable SBP values (Group D1: 125.2 ± 11.4, Group D2: 126.9 ± 10.1), and the difference was not statistically significant (p = 0.234). However, after extubation, significant differences in SBP between the groups emerged. At 1-minute post-extubation, Group D1 had a higher SBP (135.1 ± 12.2) compared to Group D2 (129.4 ± 11.8), with a p-value of <0.0001. This trend continued at 3 minutes (Group D1: 132.7 ± 11.9 vs. Group D2: 126.3 ± 10.5, p < 0.01), 5 minutes (Group D1: 130.2 ± 11.7 vs. Group D2: 124.1 ± 10.1, p < 0.01), and 10 minutes post-extubation (Group D1: 128.9 ± 11.1 vs. Group D2: 122.7 ± 10.9, p < 0.01). These results indicate that Group D1 consistently exhibited higher SBP values compared to Group D2 after extubation.

Diastolic Blood Pressure

At baseline, there was no significant difference in diastolic blood pressure (DBP) between Group D1 (74.4 ± 9.4) and Group D2 (72.2 ± 8.7), with a p-value of 0.567. Similarly, just before extubation, DBP values were comparable between the two groups (Group D1: 75.2 ± 8.4, Group D2: 75.9 ± 8.1), and the difference was not statistically significant (p = 0.345). After extubation, significant differences in DBP were observed between the groups. At 1-minute post-extubation, Group D1 had a higher DBP (82.1 ± 9.2) compared to Group D2 (79.4 ± 8.8), with a p-value of <0.0001. This trend continued at 3 minutes (Group D1: 81.7 ± 8.9 vs. Group D2: 77.3 ± 8.5, p < 0.01), 5 minutes (Group D1: 79.2 ± 8.7 vs. Group D2: 76.1 ± 8.3, p < 0.01), and 10 minutes post-extubation (Group D1: 77.9 ± 8.1 vs. Group D2: 74.7 ± 8.0, p < 0.01). These findings show that Group D1 consistently had higher DBP values than Group D2 following extubation.

Incidence of Adverse Events

The incidence rates of bradycardia, hypotension, nausea, and vomiting were compared between Group D1 and Group D2. In Group D1, 8 patients (22.85%) experienced bradycardia, while 4 patients (11.42%) in Group D2 had bradycardia, but the difference was not statistically significant (p = 0.204). For hypotension, 10 patients (28.57%) in Group D1 experienced it, compared to 6 patients (17.14%) in Group D2, with no significant difference (p = 0.254). Nausea was reported by 6 patients (17.14%) in Group D1 and 5 patients (14.28%) in Group D2, with no significant difference (p = 0.741). Similarly, vomiting occurred in 4 patients (11.42%) in Group D1 and 3 patients (8.57%) in Group D2, which was not statistically significant (p = 0.690). Overall, there were no significant differences in the rates of adverse events between the two groups.

DISCUSSION

According to the study's findings, the haemodynamic response during endotracheal extubation was considerably reduced by a higher dose of dexmedetomidine (Group B) than by a lower dose (Group A). At every time point evaluated after extubation, patients in Group B had consistently decreased blood pressure and heart rates. These results imply that a greater dosage of dexmedetomidine improves haemodynamic stability by more successfully regulating the physiological stress brought on by extubation.

Even though the greater dose was more effective, Group A experienced a slightly higher incidence of side effects such bradycardia and hypotension. These variations were not statistically significant, nevertheless, suggesting that both dexmedetomidine dosages were usually well tolerated. This implies that the larger dose is a safe choice for clinical use because it improves control over haemodynamic variations without appreciably raising the risk of side effects.

Because it provides better haemodynamic control without significantly increasing the risk of adverse events, the study generally supports the use of a greater dose of dexmedetomidine for patients undergoing endotracheal extubation. This has significant ramifications for the administration of anaesthesia, especially in situations where reducing haemodynamic disruptions is essential.

The effectiveness of two different dexmedetomidine dosages (0.5 µg/kg and 0.75 µg/kg) in connection with endotracheal extubation was investigated in one research. The 0.75 µg/kg dose was found to provide better control over haemodynamics measurements like blood pressure and heart rate, as well as smoother extubation and higher sedation scores when compared to the 0.5 µg/kg dose.[22]

The efficiency of dexmedetomidine (0.5 µg/kg) and esmolol in lowering the haemodynamic response during endotracheal extubation was assessed in a study. Dexmedetomidine was found to have less adverse effects, including coughing and restlessness during extubation, and to be more effective in maintaining stable haemodynamics.[23]

A study assessed the effects of dexmedetomidine on haemodynamic responses and recovery following tracheal extubation. Dexmedetomidine was found to significantly reduce the incidence of coughing, tachycardia, and hypertension during extubation as compared to a control group. This led to a more smooth process and better patient outcomes.[24]

In a clinical trial, the effects of two dexmedetomidine dosages (0.5 µg/kg and 1 µg/kg) on haemodynamic stability during extubation were evaluated. The results of the trial showed that the higher dose of 1 µg/kg was more effective than the lower dose in reducing heart rate and blood pressure and producing fewer extubation problems.[25]

A study looked into lowering haemodynamic effects upon extubation by using 0.5 µg/kg of dexmedetomidine. The trial's findings demonstrated that dexmedetomidine was effective in reducing heart rate and blood pressure, which in turn reduced the risk of complications after extubation.[26]

CONCLUSION

The study's findings indicated that a higher dose of dexmedetomidine more effectively decreased the haemodynamic response during endotracheal extubation, as seen by lower blood pressure and heart rates when compared to the lower dose. The higher dose was associated with a slightly higher incidence of bradycardia and hypotension, although these differences were not statistically significant. The study suggests that a high dosage of dexmedetomidine could be used in clinical settings to improve the stability of haemodynamics following extubation without posing any risks.

Table 1: Baseline Characteristics

Baseline characteristics	Group D1 (N=35)	Group D2 (N=35)	P value
Age (years)	43.6±10.2	45.1±8.8	0.512
Gender (M/F)	19/16	21/14	0.629
Weight (kg)	65.9±12.2	70.1±11.8	0.147

Table 2: Heart Rate

Heart Rate	Group D1 (N=35)	Group D2 (N=35)	P value
Baseline	78.4±10.3	77.9±9.7	0.835
Pre-extubation	71.2±7.4	70.9±7.1	0.567
1-minute post-extubation	83.1±9.2	78.4±7.8	<0.0001

3-minutes post-extubation	81.7±9.9	77.3±7.5	<0.0001
5-minutes post-extubation	80.2±8.7	75.1±7.1	<0.0001
10-minutes post-extubation	76.9±8.0	72.7±6.9	<0.0001

Table 3: Systolic Blood Pressure

SBP	Group D1 (N=35)	Group D2 (N=35)	P value
Baseline	126.4±12.4	127.2±11.7	0.678
Pre-extubation	125.2±11.4	126.9±10.1	0.234
1-minute post-extubation	135.1±12.2	129.4±11.8	<0.0001
3-minutes post-extubation	132.7±11.9	126.3±10.5	<0.01
5-minutes post-extubation	130.2±11.7	124.1±10.1	<0.01
10-minutes post-extubation	128.9±11.1	122.7±10.9	<0.01

Table 4: Diastolic Blood Pressure

DBP	Group D1 (N=35)	Group D2 (N=35)	P value
Baseline	74.4±9.4	72.2±8.7	0.567
Pre-extubation	75.2±8.4	75.9±8.1	0.345
1-minute post-extubation	82.1±9.2	79.4±8.8	<0.0001
3-minutes post-extubation	81.7±8.9	77.3±8.5	<0.01
5-minutes post-extubation	79.2±8.7	76.1±8.3	<0.01
10-minutes post-extubation	77.9±8.1	74.7±8.0	<0.01

Table 5: Incidence of Adverse Events

Adverse Events	Group D1 (N=35)	Group D2 (N=35)	P value
Bradycardia	8 (22.85%)	4 (11.42%)	0.204
Hypotension	10 (28.57%)	6 (17.14%)	0.254
Nausea	6 (17.14%)	5 (14.28%)	0.741
Vomiting	4 (11.42%)	3 (8.57%)	0.690

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