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To compare the effect of varying doses of dexmedetomidine on airway reflexes and hemodynamic responses during tracheal extubation in patients undergoing surgery under general anaesthesia

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Abstract

Background: *Extubation of the trachea is the process of discontinuing the artificial airway when the necessities for its use like protection of the airway, ventilation, airway obstruction, and hypoxia were corrected.*

It is one of the most uncomfortable states during general anaesthesia. It is a well known factor that, after tracheal extubation, there is an increase in arterial blood pressure and heart rate associated with an increase in plasma concentrations of both nor, adrenaline and adrenaline. It is almost always associated with hemodynamic parameter changes

Different techniques and drugs have been tried from time to time to attenuate the stress responses and airway responses during tracheal extubation. But none of the methods has been completely successful.

Many trials have been conducted to attenuate the hemodynamic and stress responses during tracheal extubation by using various drugs like inhalational agents, opioids, local anaesthetics, vasodilators, alpha blockers, beta blockers and calcium channel blockers.

Studies have been carried out using fentanyl, sevoflurane, Lignocaine, Propofol, magnesium sulphate, nitroglycerine, clonidine, esmolol, labetolol, metoprolol, verapamil, nicardipine, diltiazem, etc., either as a sole agent or in comparison with each other with this background.

This study was conceptualized to analyze the varying doses of dexmedetomidine on the hemodynamic and recovery profiles during endotracheal extubation.

Aim & Objectives

Aims of the Study: *To compare the effect of varying doses of dexmedetomidine on airway reflexes and hemodynamic responses during tracheal extubation in patients undergoing surgery under general anaesthesia.*

Objectives of the Study

1. *To study the hemodynamic effects of dexmedetomidine on the patient during Extubation.*
2. *To compare the quality of extubation of dexmedetomidine with respect to the patientsresponse.*
3. *To study the emergence - agitation response of the patient to dexmedetomidine during and following endotracheal Extubation.*

Methods: *This is a prospective randomized comparative study of Dexmedetomidine group-D1 versus Dexmedetomidine group-D2 on the hemodynamic and recovery responses during tracheal extubation. This study was carried out in 60 patients belonging to ASA I & II, aged between 20 and 60 undergoing elective surgery. These 60 patients were allocated into two groups – group D1 for Dexmedetomidine group-D1 and group D2 for Dexmedetomidine group-D2 with 30 in each group.*

Results: *Patients in the dexmedetomidine group-D2 had a lesser increase in heart rate during and after extubation compared todexmedetomidinegroup-D1, which is statistically significant. Patients in the dexmedetomidine group-D2 had a better control of systolic arterial pressure compared to dexmedetomidine group-D1 during and after extubation, which is statistically significant.*

Patients in the dexmedetomidine group-D2 are associated with a lesser rise in diastolic blood pressure during and after tracheal extubation compared to dexmedetomidine group-D1 which is statistically significant.

There is a statistically significant difference in the mean arterial pressure between Dexmedetomidine group-D2 and Dexmedetomidine group-D1. The dexmedetomidine group D2 is associated with a better control of the mean arterial pressure at the time of extubation and the period following extubation.

The Quality of Extubation was observed to be better with the Dexmedetomidine group-D2 as compared with the Dexmedetomidine group-D1 and is statistically significant.

Conclusion: *To conclude, Dexmedetomidine Group-D2 (0.75µ/kg) administered before tracheal extubation, was more effective in maintaining the hemodynamic stability, facilitated smooth tracheal extubation and had a better quality of recovery compared to Dexmedetomidine Group-D1(0.5µ/kg).*

Keywords: *Extubation, Dexmedetomidine*

Introduction

Extubation of the trachea is the process of discontinuing the artificial airway when the necessities for its use like protection of the airway, ventilation, airway obstruction, and hypoxia were corrected.

It is one of the most uncomfortable states during general anaesthesia. It is a well known factor that, after tracheal Extubation, there is an increase in arterial blood pressure and heart rate associated with an increase in plasma concentrations of both nor, adrenaline and adrenaline. It is almost always associated with hemodynamic parameter changes. Endotracheal Extubation is the translaryngeal removal of a tube from the trachea via the nose or mouth.

Tracheal Extubation during lighter planes of anaesthesia or sedation can stimulate reflexes by laryngeal and tracheal irritation. The laryngopharyngeal stimulation is almost associated with a reflex increase in sympathetic activity leading to changes in hemodynamic profile.

These hemodynamic changes are reflected as an increase in heart rate and arterial blood pressure and are usually variable, transitory, and unpredictable. It is more dangerous in patients who have systemic hypertension, heart disease, intracranial aneurysms and cerebrovascular disease, and other co-morbid conditions.

The transient changes in arterial blood pressure and heart rate can result in potentially deleterious effects like cerebral hemorrhage, cardiac arrhythmias, myocardial ischemia, left ventricular failure, pulmonary edema, and rupture of intracranial aneurysms.

For the endotracheal extubation to be smooth, the patient should not have any straining, coughing, bucking, movement, holding of breath, laryngospasm, or broncho spasm. Different techniques and drugs have been tried from time to time to attenuate the stress responses and airway responses during tracheal extubation. But none of the methods has been completely successful.

Many trials have been conducted to attenuate the hemodynamic and stress responses during tracheal extubation by using various drugs like inhalational agents, opioids, local anaesthetics, vasodilators, alpha blockers, beta blockers and calcium channel blockers.

Studies have been carried out using fentanyl, sevoflurane, Lignocaine, Propofol, magnesium sulphate, nitroglycerine, clonidine, esmolol, labetolol, metoprolol, verapamil, nicardipine, diltiazem, etc., either as a sole agent or in comparison with each other with this background.

This study was conceptualized to analyze the varying doses of dexmedetomidine on the hemodynamic and recovery profiles during endotracheal Extubation.

Materials and Methods

Inclusion Criteria

1. ASA Physical status 1 & 2
2. Men and women aged between 20 and 60 years undergoing surgery under GA

Exclusion Criteria

1. Patients <20 years of age.
2. Patients >60 years of age.
3. Hemodynamically unstable patients.
4. Patients with cardiorespiratory disorders (medications that effect heart rate
5. Patients with history of sleep apnea

Sample Size

Was determined on the basis of a pilot study and a calculated minimum sample size of 24 patients were required within each group, assuming Type-1 error of 0.05 and a margin of error 10%.

Therefore, the final sample selected was n=30 in group 1 and n=30 in group 2.

Two Groups

- Group D1: Patients in this group received 0.5 μ/kg of dexmedetomidine in 100ml of Normal Saline (NS) over 10 minutes. Given 15 minutes prior to the expected last surgical suture.
- Group D2: Patients in this group received 0.75 μ//kg of dexmedetomidine in 100ml of Normal Saline (NS) 10 minutes. Given 15 minutes prior to the expected last surgical suture.

Methodology

Institutional ethical committee approval was obtained.

Pre anaesthetic assessment of the patient was done with a complete history, physical examination, and routine investigations.

Informed written consent was obtained from all patients. Age, weight, height, and body mass index of the patients were noted.

All patients were premedicated with Inj. Glycopyrrolate 0.2 mg IV, Inj. Midazolam 1 mg IV Inj. Ranitidine 50 mg IV and Inj. metoclopromide 4 mg IV.

Monitoring in the operation theatre included pulseoximetry, non invasive blood pressure, five-leadelectrocardiograms, capnography.

Preoxygenation was done with 100 % oxygen for three minutes

The patient was induced with inj. Fentanyl 2mcg / kg, Inj. Propofol 2 mg / kg, Inj. Rocuronium 1 mg / kg and endotracheal intubation was done.

Anaesthesia was maintained with nitrous oxide and oxygen in the ratio of 66% : 33% along with sevoflurane 2 –2 % . Inj. Rocuronium was repeated in the dose of 10 mg for the maintainence of muscle relaxation and End Tidal Carbon dioxide was maintained between 35 – 40 mm Hg.

Normal saline and ringer lactate were used for volume replacement and maintenance.

The patients were categorized into two different groups using the sealed envelope method.

GROUP DRUG Group-D1-Dexmedetomidine(0.5μ/kg)	 Group-D2- Dexmedetomidine(0.75μ/kg)
Sevoflurane was cut off in both groups before drug administration. The patients in Group D1 received a dexmedetomidine infusion of 0.5 μg / kg in 100 ml of 0.9 % Normal Saline (NS) administered 15 minutes before the expected last surgical suture over a period of 10 minutes .	Sevoflurane was cut off in both the groups before drug administration. The patients in Group D1 received a dexmedetomidine infusion of 0.75 μg / kg in 100 ml of 0.9 % Normal Saline (NS) administered 15 minutes before the expected last surgical suture over a period of 10 minutes.

Reversal of the neuromuscular blockade was done with Inj. Glycopyrrolate 20 μ / kg and Inj. Neostigmine 50 μ / kg and the trachea was extubated when the spontaneous breathing efforts were adequate and the patient obeyed commands.

➢ Initial parameters like the heart rate, systolic arterial blood pressure, diastolic arterial blood pressure, and mean arterial pressure were documented in both groupsat the time of administration of drug 1,5,10, and 15 minutes after giving reversal injection, 1,5,10, and 15 minutes after extubation in group D1 and D2.

➢ Extubation response was analyzedusing a five-point score (Extubation quality score) based on the patient's comfort and response.

Extubation Quality Score	Smoothness Of Extubation
1	Patient is having no cough
2	Smooth Extubation, Minimal Coughing (one or two times)
3	Moderate coughing - three or four times
4	Sever coughing - five to ten times and straining
5	Poor Extubation, very uncomfortable (laryngospasm and coughing) more than ten times

Any adverse effects like Respiratory depression, Delayed arousal, Bradycardia was recorded.

All data analysis was performed by using the computer software SPSS for windows and P value less than 0.05 was considered as statistically significant.

Results

This study was performed on ASA PS I and II patients belonging to the age group of 20 – 60 years who were posted for elective surgery under general anaesthesia. A comparative study between varying doses of dexmedetomidine on airway reflexes and hemodynamic responses were carried out, 60 patients categorized into 2 groups of 30 each. All data were complied, tabularized, and formulated as mean +/- standard deviation. All data that were collected were compared using an independent „t" test. A statistically significant difference was concluded if the value of $P < 0.05$.

The P values of heart rate after giving,reversal, and extubation are 0.001, 0.046, 0.026, 0.014, and 0.027. which is statistically significant.

The P values of Systolic Blood Pressure after giving reversal and extubation are 0.007, 0.012, 0.006, 0.011, and 0.006. which is statistically significant.

The P value of Diastolic Blood Pressure after giving reversal and extubation are 0.046, 0.002, 0.026, 0.017, 0.026, 0.005, 0.002 and 0.009 which is statistically significant.

The P values of Mean Arterial Pressure after giving,reversal, and extubation are 0.005, 0.026, 0.020, 0.038, 0.003, 0.001 and 0.047 which is statistically significant.

Statistical analysis of the Extubation Quality score shows a P value of 0.003, which is statistically significant.

Statistical analysis of the adverse effects shows a P value of 0.006, which is statistically significant.

Factors such as height, weight, age, ASA status, sex, respiratory rate, spO2, time to emergence, mean time to extubate, sedation score had no significant statistical difference between the study groups

Discussion

Extubation of the trachea is associated with wide fluctuations in hemodynamics that can lead to

tachycardia, hypertension, and arrythmias. It is also associated with reflex increases in airway reactivity leading to stress responses and airway irritation.

Dexmedetomidine is associated with control of these hemodynamic changes and stressful airway responses. This study was undertaken to analyze the effects of varying doses of dexmedetomidine on variations in hemodynamics and recovery responses during tracheal extubation.

This study was conducted in 60 patients belonging to ASA I AND II, between the age group of 20 to 60 years of age who were posted for elective surgery.

Heart Rate

Nageshwara Rao et al. compared the effects of dexmedetomidine with fentanyl in 60 patients of 30 in each group. They found a statistically significant difference in the heart rate beginning from 1 minute, 5 minutes, 10 minutes, 15 minutes, and after extubation.

In my study, the heart rate got increased in both groups, dexmedetomidine compared to their baseline values. But, the use of dexmedetomidine 0.75 µ/kg was associated with a lesser increase in heart rate compared to that dexmedetomidine 0.5 µ/kg

The heart rate variations between dexmedetomidine 0.75 µ/kg and dexmedetomidine 0.5 µ/kg were statistically significant from the time of extubation and it continued after extubation till the time , the observations were recorded.

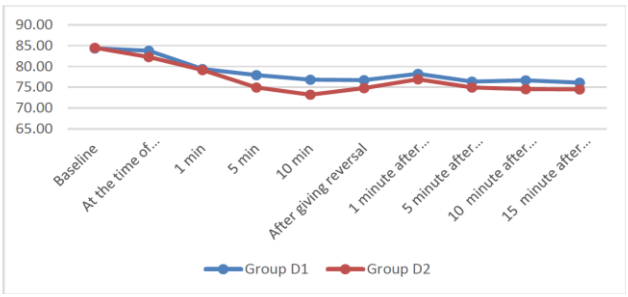

Fig 1. : Heart Rate

Systolic Blood Pressure

Nageshwara Rao et al. observed that the systolic blood pressure varies statistically significantly between dexmedetomidine and fentanyl starting from 1minute after the drug administration and it continued until the observations were made. In my study, the systolic blood pressure variations between dexmedetomidine D1 and D2 were statistically significant from the time of extubation and it continued after extubation until the time, the observations were recorded. So, dexmedetomidine 0.75µ/kg controlled systolic blood pressure better than dexmedetomidine 0.5 µ/kg. The findings are similar to the above-mentioned study.

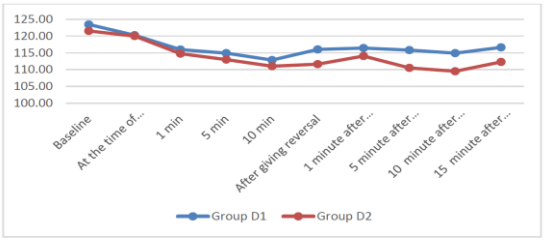

Fig 2: Systolic Blood Pressure

Diastolic Blood Pressure

Nageshwara Rao et al. observed that the diastolic blood pressure showed a statistically significant difference between dexmedetomidine and fentanyl starting from 1 minute after the drug administration which continued till the observations were made.

In my study, the diastolic blood pressure variations between dexmedetomidine-D1 and dexmedetomidine-D2 were statistically significant from the time of extubation and it continued after extubation till the time, the observations were recorded. So, the findings are concurrent with the above-mentioned study.

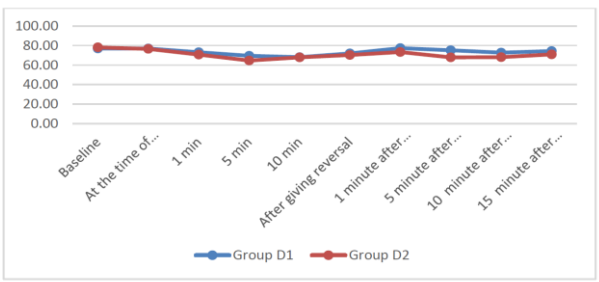

Fig 3: Diastolic Blood pressure

Mean Arterial Pressure

Nageswara Rao et al. observed that the mean arterial blood pressure varied statistically significant between dexmedetomidine and fentanyl groups starting from ten minutes after the drug administration and it continued till the observations were made.

In my study, the mean arterial pressure got elevated in both groups It was observed that dexmedetomidine 0.75µ/kg had a better control over mean arterial pressure compared to that of dexmedetomidine 0.5µ/kg and it remained statistically significant from the time of extubation till the observations were made. So, the findings are similar to the above-mentioned study.

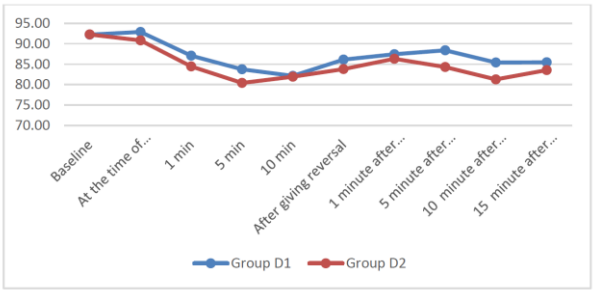

Fig 4: Mean Arterial Pressure

Extubation Quality Score

Nageswara Rao et al. observed in their study that the quality of extubation was better in the dexmedetomidine group. 33% patients in the group dexmedetomidine had minimal cough, whereas 60% patients had moderate cough during extubation. In the fentanyl group, 50 % patients had severe cough during extubation, whereas only 10 % patients had minimal cough.

In my study, 43.3% of the patients were extubated smoothly in the dexmedetomidine0.75 µ/kg group with minimal cough, whereas only 13.3 % of the patients were extubated smoothly in the o.5 µ/kg group. Moreover, in the dexmedetomidine0.75 µ/kg group, 0 % of the patients had moderate cough, whereas, in the dexmedetomidine 0.5 µ/kg, 23.3% of the patients had moderate cough during extubation.

Hence, in my study, the quality of extubation is better with dexmedetomidine 0.75 µ/kg when compared with dexmedetomidine 0.5 µ/kg which is in concurrence with the study of Barkha Bindu et al.

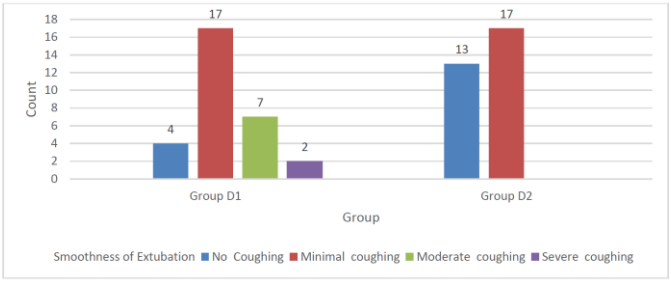

Fig 5: Extubation quality score

Sedation Score

NagaeswaraRao et al. observed in their study that 93.3% of the patients in the dexmedetomidine group were awake and alert, whereas, in the fentanyl group, 90 % of the patients were oriented, cooperative and tranquil.

In my study shows that the sedation score during extubation and the quality of sedation in the postoperative period werethe same in bothgroups.

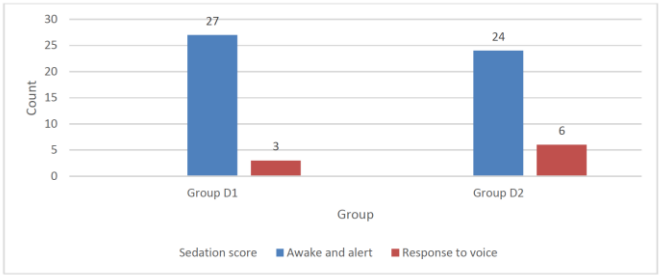

Fig 6: Sedation Score charting

Adverse Effects

In the study conducted by Nageswara Rao et al., the occurrence of bradycardia was more in the dexmedetomidine group than the fentanyl group. 3.3% of the patients in the dexmedetomidine group had bradycardia, whereas, in the fentanyl group, 0 % had bradycardia , but treatment was not required in any of the patients. In a my study, 6.7 % of the patients in the dexmedetomidine 0.5µ/kg group and 23.3 % of the patients in the dexmedetomidine o.75µ/kg group developed bradycardia respectively, but none of them required intervention.

Conclusion

To conclude, Dexmedetomidine Group-D2 (0.75μ/kg) administered before tracheal extubation, was more effective in maintaining the hemodynamic stability, facilitated smooth tracheal extubation and had a better quality of recovery compared to Dexmedetomidine Group-D1(0.5μ/kg).

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