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A comparison of effects of dexmedetomidine versus fentanyl on airway reflexes and haemodynamic responses to tracheal extubation during nasal surgeries: A double blind randomized study

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Abstract
Aims: Comparison of the effects of Dexmedetomidine versus fentanyl on airway reflexes and haemodynamic responses to tracheal extubation during nasal surgeries.
Materials & methods: 60 patients of either sex, aged 18-60 years of ASA grade I or II scheduled for elective nasal surgeries under general anaesthesia were analyzed. The patients were randomly divided into 2 groups (Group D & Group F) of 30 each (Group D received Dexmedetomidine & Group F received Fentanyl). Pre-anaesthetic check up was done one day before surgery in every patient. Cardiovascular parameters were recorded during preoxygenation (T1), after 5min of induction (T2), after 20 minutes of induction (T3), after every 10mins interval intra operative till 60 minutes after induction (T4,T5,T6) and 10,5 and 1minute before extubation (E10,E5,E1). Postoperative sedation was assessed on a six-point scale (Ramsay scale). Modified Aldrete scoring was recorded every 15 minutes for first 1 hour. A score of nine or more points was required for eligibility to discharge from the recovery room.
Results: There was a significant difference between the groups with respect to extubation quality. The prevalence of no coughing was significantly higher in patients in the Dexmedetomidine group compared with those in the fentanyl group. No significant difference was found in sedation scores and modified aldrete scores between group D and group F.
Conclusion: Dexmedetomidine administered before tracheal extubation, was more effective in maintaining the haemodynamic stability, facilitated smooth tracheal extubation and had a better quality of recovery as compared to fentanyl.

Keywords: Dexmedetomidine, Fentanyl, Extubation

Introduction
Nasal surgeries are performed under various types of anaesthesia including local anaesthesia, intravenous sedation (also called twilight anaesthesia, MAC anaesthesia, or IV sedation), and general anaesthesia. Longer cases are far better tolerated and the airway is protected from aspiration by the presence of an endotracheal tube. Endotracheal tubes are initially placed to secure an airway, or to provide positive pressure ventilation and to prevent aspiration. Most of the problems related to endotracheal extubation are minor but complications can range from minor to severe. Extubation of trachea is the process of discontinuing artificial airway that is removal of endotracheal tube. It is one of the most uncomfortable state during general anaesthesia and is almost always associated with haemodynamic changes [1- 3].
When a patient is under deep anaesthesia, tracheal extubation during nasal surgery can be difficult because of an obstructed nasal airway, blood and secretions in the pharynx, and difficulty performing manual ventilation by face mask owing to the newly reconstructed nose. However, when a patient is lightly anaesthetized, extubation can stimulate reflex responses via tracheal and laryngeal irritation following stimulation of epipharyngeal and laryngopharyngeal structures [4- 6].
Many drugs have been proposed to decrease airway and cardiovascular responses but none have been completely successful. Trials have been conducted to attenuate the haemodynamic and stressor. Dexmedetomidine an alpha2 agonist is analgesic sparing and inhibitor of salivary secretion. Fentanyl, a synthetic opioid, fentanyl suppresses the haemodynamic

response by increasing the depth of anaesthesia and decreasing the sympathetic discharge [7- 9].

Hence; the present study was undertaken for assessing and comparing the effects of dexmedetomidine versus fentanyl on airway reflexes and haemodynamic responses to tracheal extubation during nasal surgeries.

Materials & methods

After institutional review board approval and informed written consent from the patients, this clinical prospective study was carried out in 60 patients of either sex, aged 18-60 years of ASA grade I and II scheduled for elective nasal surgeries under general anaesthesia at Govt. Medical College, Rajindra Hospital, Patiala. The patients were randomly divided into 2 groups (Group D & Group F) of 30 each (Group D received Dexmedetomidine & Group F received Fentanyl). Pre-anaesthetic check up was done one day before surgery in every patient.

On the day of surgery, after confirmation of NPO status patients were shifted to OT and were connected to multichannel monitor. Two I.V lines were secured with 18G cannula & preloading with 500 ml ringer lactate was done. Basal Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP), Heart rate (HR), and SpO2 were recorded after 5mins of settling in OT (T0) [Baseline]. Rhythm monitoring from a continuous visual display of ECG along with continuous monitoring of the vital parameters was done. Prior to induction, inj. Glycopyrrolate 0.2mg (10mcg/kg), inj. Ondansetron 4mg (100mcg/kg), & inj Ranitidine 50mg (1mg/kg) was given intravenously.

After pre oxygenation with 100% Oxygen for 3 minutes, all patients were induced with Propofol and for twin. 5mg/kg I/V. The dose of propofol was controlled by the haemodynamic and cardiovascular parameters, loss of eyelash and corneal reflex followed by Succinylcholine 2 mg/kg to facilitate tracheal intubation. Patients were intubated with an appropriate sized, orally cuffed, disposable endotracheal tube.

Anaesthesia was maintained with intermittent positive pressure ventilation with mixture of N2O and O2. Isoflurane and using Inj Vecuronium bromide 0.08 mg/kg to 0.1 mg/kg I.V. bolus followed by maintenance dose 1/4th of the initial dose depending upon requirement. Cardiovascular parameters were recorded during preoxygenation (T1), after 5min of induction (T2), after 20 minutes of induction (T3), after every 10mins interval intra operative till 60 minutes after induction (T4,T5,T6) and 10,5 and 1minute before extubation (E10,E5,E1).

Test drugs were prepared by the persons not involved in the study and were handed over to the anaesthetists who were unaware of the drugs. Before extubation, patients received dexmedetomidine 0.5 µg/kg IV over 5 minutes (dexmedetomidine group) or fentanyl 1 µg/kg IV over 5 minutes (fentanyl group). Isoflurane and nitrous oxide were discontinued when surgery was completed. At the end of surgery, neuromuscular blockade was reversed with neostigmine 50 µg/kg and glycopyrrolate 10 µg/kg intravenously. Suction was done for or pharyngeal secretions. Patients were extubated and transferred to postanesthesia care unit (PACU).

In PACU, HR, SBP, DBP, MAP, SpO2, were recorded at 1,5 and 10 minute after extubation (AE1, AE5, AE10) and any incidence of complications/adverse event was monitored. Extubation quality was rated using a 5-point scale: 1 = no coughing; 2 = smooth extubation, minimal coughing (1 or 2 times); 3 = moderate coughing (3 or 4 times); 4 = severe coughing (5–10 times) and straining; and 5 = poor extubation, very uncomfortable (laryngospasm and coughing >10 times), extubation is poor and patient is restless. Postoperative sedation was assessed on a six-point scale (Ramsay scale). Modified Aldrete scoring was recorded every 15 minutes for first 1 hour. A score of nine or more points was required for eligibility to discharge from the recovery room. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Chi-square test and independent t test were used for assessment of level of significance.

Results

In Group D and Group F, the mean age of the patients was found to be 28.53 years and 32.20 years respectively. The difference between Group D and Group F was statistically not significant. In Group D, out of 30 patients, 19 (63.3%) patients were males and 11 (36.7%) patients were females and in Group F, 18(60%) patients were males and 12(40%) patients were females. There was no significant difference in mean heart rate during baseline, preoxygenation, 5,20,30,40 and 60 minutes. Also while comparing the mean heart rate before extubation in between the two study groups, non-significant results were obtained. Mean heart rate values at 1,5 and 10 minutes after extubation were 85.33, 83.93, 83.16 respectively in group D (dexmedetomidine) and 89.7, 90.36, 88.73 in group F (fentanyl). On comparing mean heart rate between two groups at 5 and 10 minute after extubation highly significant difference were found between two groups ($p<.001$) and significant difference was found at 1 minute after extubation. No-significant difference while observed while comparing the mean systolic blood pressure and Mean SPO_2at different time intervals. Mean diastolic blood pressure values at 1,5 and 10 minutes after extubation were 123.33,121.53,121.07 respectively in group D (dexmedetomidine) and 128.27, 127.80, 125.53. In group F(fentanyl). On comparing mean diastolic blood pressure between two groups at 1,5 and 10 minute after extubation highly significant difference were found between two ($p<.001$).

Mean arterial pressure values at 1,5 and 10 minutes after extubation were 96.00, 94.50, 95.03 respectively in group D (dexmedetomidine) and 101.432, 100.732, 99.9667. In group F (fentanyl). On comparing mean arterial pressure between two groups at 1,5 and 10 minute after extubation highly significant difference were found between two ($p<.001$).

There was a significant difference between the groups with respect to extubation quality. The prevalence of no coughing was significantly higher in patients in the dexmedetomidine group compared with those in the fentanyl group (80% [24] vs 50 % [12] of patients.1 patient in Dexmedetomidine experienced moderate coughing and 4 patients in fentanyl group had moderate coughing. No patient in the dexmedetomidine group experienced severe coughing, whereas 4 patients (13.3%) in the fentanyl group experienced severe coughing. Laryngospasm did not occur in any patient in either group. Mean extubation score was 1.233 in dexmedetomidine group and 1.967 in fentanyl group. On comparing the two groups, highly significant

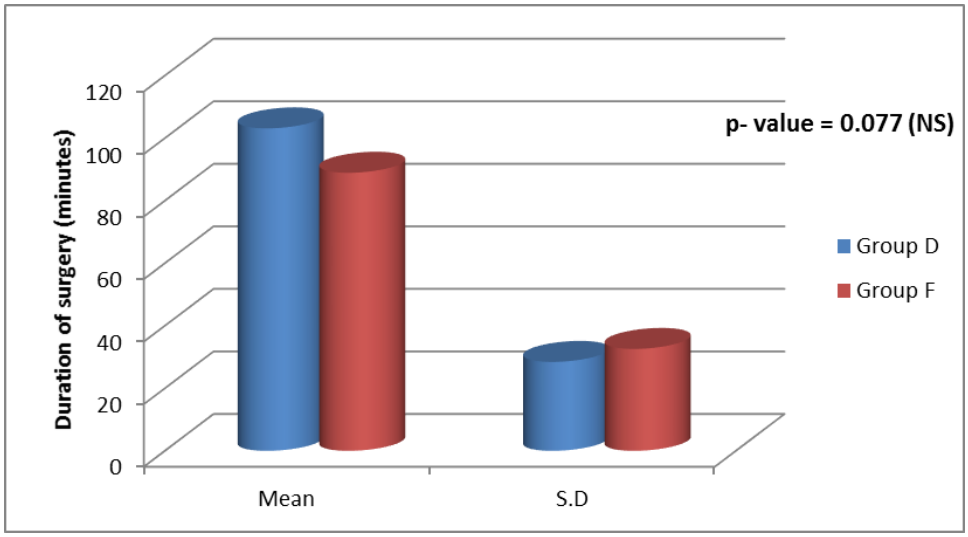
difference was obtained.

Ramsay sedation score was recorded immediately after extubation, 1hr, 2hr, 3hr and 4hr, after extubation. Mean sedation score values were 2.80, 2.6, 2.26, 1.73, 1.80 in group D (dexmedetomidne) and 2.73, 2.43, 2.10, 1.50, 1.56 in group F (fentanyl) respectively. No significant difference was found in sedation scores between group D and group F.

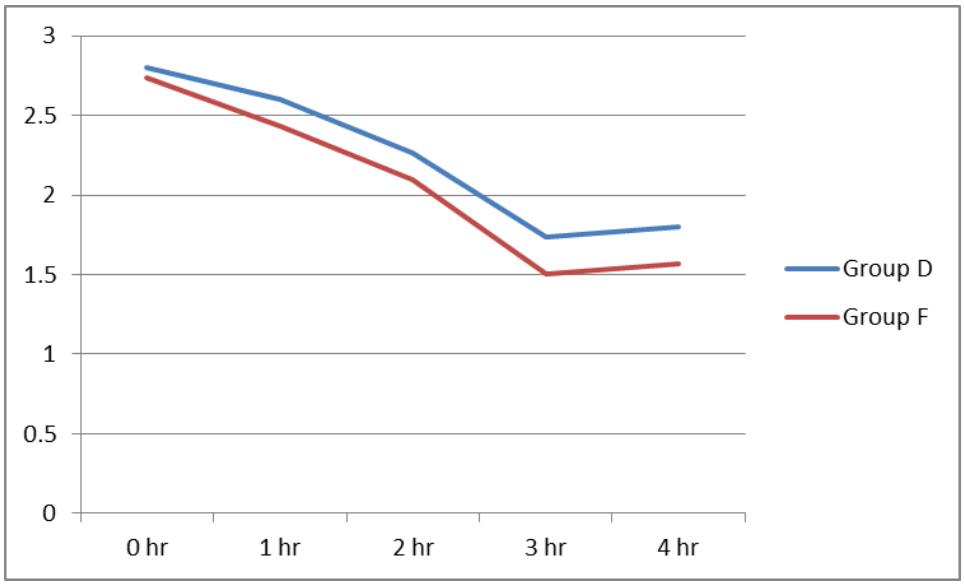
In my study, Modified Aldrete Score was recorded immediately after extubation, 15 min, 30 min, 45 min and 60 min after extubation. Mean score values were 9.83, 9.96, 10, 10, 10.00 in group D (dexmedetomidne) and 9.8-9.80, 10, 10, 10, 10 in group F (fentanyl) respectively. No significant difference was found in modified aldrete scores between group D and group F(p>.05). None of the patient had respiratory depression, laryngospasm or bronchospasm, shivering.

Table 1: Demographic and clinical data

Parameter		Group D		Group F	
		n	%	N	%
Gender	Males	19	63.3	18	60.0
	Females	11	36.7	12	40.0
Mean age (years)		28.53		32.20	



Graph 1: Duration of surgery



Graph 2: Sedation

Table 2: HR

HR	Groups	mean	S.D	P value	Significance
T0	Group D	85.9000	11.55004	0.705	NS
	Group F	84.7333	12.19930		
T1	Group D	86.0333	12.24318	0.991	NS
	Group F	86.0000	11.45606		
T2	Group D	83.4333	11.40382	0.284	NS
	Group F	86.5333	10.77908		
T3	Group D	85.8333	10.26908	0.762	NS
	Group F	86.6333	10.08407		

T4	Group D	97.0667	7.96948	0.650	NS
	Group F	98.0333	8.45060		
T5	Group D	87.2000	10.46307	0.067	NS
	Group F	92.3667	10.96227		
T6	Group D	88.1000	8.82532	0.581	NS
	Group F	89.3667	8.83755		
E10	Group D	85.0667	11.44683	0.516	NS
	Group F	86.7000	7.52536		
E5	Group D	85.4333	11.20555	0.732	NS
	Group F	86.2667	7.10480		
E1	Group D	85.1000	10.14158	0.877	NS
	Group F	85.4815	8.13525		
AE1	Group D	85.3333	9.56406	0.035	S
	Group F	89.7000	5.64557		
AE5	Group D	83.9333	9.89229	0.002	HS
	Group F	90.3667	5.02053		
AE10	Group D	83.1667	9.31844	0.008	HS
	Group F	88.7333	6.00536		

Table 3: SBP

SBP	Groups	mean	S.D	P value	Significance
T0	Group D	126.93	10.79889	0.361	NS
	Group F	129.47	10.52987		
T1	Group D	125.93	9.77658	0.227	NS
	Group F	128.93	9.24357		
T2	Group D	123.00	9.98965	0.066	NS
	Group F	127.67	9.30826		
T3	Group D	120.33	11.29032	0.057	NS
	Group F	125.33	8.44182		
T4	Group D	136.47	11.13780	0.549	NS
	Group F	138.00	8.35423		
T5	Group D	129.90	9.36740	0.567	NS
	Group F	131.20	8.07892		
T6	Group D	125.20	7.72992	0.414	NS
	Group F	126.87	7.95996		
E10	Group D	121.57	4.68073	0.079	NS
	Group F	123.93	5.54563		
E5	Group D	122.77	7.37041	0.400	NS
	Group F	124.20	5.59187		
E1	Group D	121.80	6.46156	0.301	NS
	Group F	123.33	4.26073		
AE1	Group D	123.33	5.51695	<0.001	HS
	Group F	128.27	4.63073		
AE5	Group D	121.53	7.47748	0.001	HS
	Group F	127.80	6.50411		
AE10	Group D	121.07	5.95925	0.004	HS
	Group F	125.53	5.64913		

Table 4: DBP

DBP	Groups	mean	S.D	P value	Significance
T0	Group D	83.7333	5.84237	0.561	NS
	Group F	84.8000	8.09598		
T1	Group D	83.8667	7.23847	0.113	NS
	Group F	86.9333	7.53353		
T2	Group D	82.6000	5.78106	0.114	NS
	Group F	85.3000	7.15903		
T3	Group D	82.1000	6.13835	0.465	NS
	Group F	83.3000	6.48154		
T4	Group D	92.8667	5.24393	0.415	NS
	Group F	94.0667	6.04542		
T5	Group D	87.6000	5.61771	0.223	NS
	Group F	89.4000	5.70904		
T6	Group D	83.0000	6.31910	0.783	NS
	Group F	81.8667	21.54023		
E10	Group D	81.4667	6.68366	0.280	NS
	Group F	83.2000	5.57334		
E5	Group D	80.8333	6.06905	0.073	NS

	Group F	83.4667	5.03596		
E1	Group D	81.6000	5.73916	0.471	NS
	Group F	82.5333	4.09990		
AE1	Group D	82.4000	5.56838	<0.001	HS
	Group F	87.9333	3.87684		
AE5	Group D	80.9667	5.52414	<0.001	HS
	Group F	87.1333	4.19140		
AE10	Group D	81.9667	5.28161	<0.001	HS
	Group F	87.2000	4.88770		

Table 5: MAP

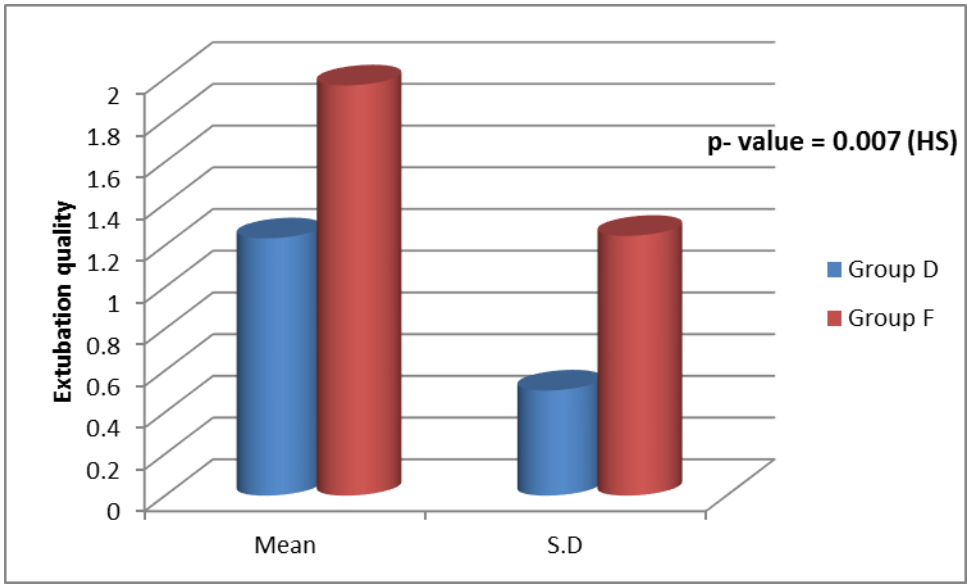
MAP	Groups	mean	S.D	P value	Significance
T0	Group D	98.1667	6.96337	0.412	NS
	Group F	99.8000	8.28126		
T1	Group D	97.8667	7.42658	0.123	NS
	Group F	100.9000	7.59923		
T2	Group D	96.0667	6.28042	0.058	NS
	Group F	99.4667	7.30957		
T3	Group D	94.8667	6.84172	0.164	NS
	Group F	97.3000	6.51338		
T4	Group D	107.4300	6.27355	0.401	NS
	Group F	108.7300	5.60131		
T5	Group D	101.7300	5.61975	0.264	NS
	Group F	103.4000	5.82859		
T6	Group D	97.0000	5.55847	0.972	NS
	Group F	96.9000	14.76330		
E10	Group D	94.7667	5.10364	0.129	NS
	Group F	96.7333	4.79176		
E5	Group D	94.8333	5.21988	0.069	NS
	Group F	97.1000	4.19647		
E1	Group D	95.0000	4.85656	0.241	NS
	Group F	96.2667	3.26880		
AE1	Group D	96.0000	4.38650	<0.001	HS
	Group F	1.0143E2	3.83885		
AE5	Group D	94.5000	5.25062	<0.001	HS
	Group F	1.0073E2	3.89459		
AE10	Group D	95.0333	3.95216	<0.001	HS
	Group F	99.9667	4.08093		

Table 6: SPo2

SPo2	Groups	Mean	S.D	P value	Significance
T0	Group D	100.00	.00000	-	-
	Group F	100.00	.00000		
T1	Group D	99.9333	.36515	0.321	NS
	Group F	100.00	.00000		
T2	Group D	99.9333	.25371	0.584	NS
	Group F	99.9333	.36515		
T3	Group D	99.8000	.55086	0.233	NS
	Group F	99.9333	.25371		
T4	Group D	99.9000	.30513	1.000	NS
	Group F	99.9000	.30513		
T5	Group D	99.9333	.36515	0.326	NS
	Group F	100.00	.00000		
T6	Group D	99.9667	.18257	0.321	NS
	Group F	100.00	.00000		
E10	Group D	100.00	.00000[a]	-	
	Group F	100.00	.00000[a]		
E5	Group D	99.9667	.18257	0.321	NS
	Group F	100.00	.00000		
E1	Group D	100.00	.00000	-	
	Group F	100.00	.00000		
AE1	Group D	99.9667	.18257	-	
	Group F	.	.		
AE5	Group D	1.0000	.00000	-	
	Group F	.	.		
AE10	Group D	99.9333	.25371	-	
	Group F	.	.		

Table 7: MAS

MAS	Groups	mean	S.D	P value	Significance
0 hr	Group D	9.8333	.37905	0.741	NS
	Group F	9.8000	.40684		
1 hr	Group D	9.9667	.18257	0.317	NS
	Group F	10.0000	.00000		
2 hr	Group D	10.0000	.00000	-	-
	Group F	10.0000	.00000		
3 hr	Group D	10.0000	.00000	-	-
	Group F	10.0000	.00000		
4 hr	Group D	10.0000	.00000	-	-
	Group F	10.0000	.00000		



Graph 3: Extubation quality

Discussion

Endotracheal extubation is one of the most frequently performed procedures in anaesthesia. Numerous strategies have been used to prevent hemodynamic responses caused by emergence from anesthesia including extubation under deep anesthesia, administration of local aesthetics, vasodilators and short-acting opioids [10-13]. Hence the present study was undertaken for assessing and comparing the effects of dexmedetomidine versus fentanyl on airway reflexes and haemodynamic responses to tracheal extubation during nasal surgeries.

In our study, distribution of patients according to age, weight and gender was similar in both groups and statistically no significant difference was seen between two groups. Non-significant results were obtained while comparing the mean SpO^2 and Mean arterial saturation in between group D (dexmedetomidine) and group F (Fentanyl). R. Aksu *et al.*, compared intravenous dexmedetomidine0.5 µg/kg with intravenous fentanyl 1 µg/kg given before extubation in 40 patients who underwent rhinoplasty and concluded that there was no significant difference inSpo2 between two groups after tracheal extubation [14].

In our study, the heart rate variations were statistically non-significant between dexmedetomidine and fentanyl group during the entire duration of surgery till extubation. No significant difference in heart rate was found at t0, t1, t2, t3, t4, t5 and t6. The diastolic blood pressure variations between dexmedetomidine and fentanyl were statistically significant from the time of extubation and till the time, the observations were recorded. Barkha Bindu *et al.*, compared the effects of dexmedetomidine with placebo in fifty patients of twenty five in each group. They found a statistically significant difference in the heart rate beginning from ten minutes from the time of dexmedetomidine administration which continued till twenty minutes after extubation [15]. R. Amutharani *et al.* compared intravenous dexmedetomidine and fentanyl to attenuate haemodynamic stress response to tracheal extubation in 180 patients of 60 in each group that is dexmedetomidine, fentanyl and normal saline and found that dexmedetomidine group had a statistically significant lesser increase in HR than the fentanyl group during extubation and up to 100 minutes after extubation [16].

There was a significant difference between the groups with respect to extubation quality. The prevalence of no coughing was significantly higher in patients in the dexmedetomidine group compared with those in the fentanyl group. R. Aksu *et al.*, found that the fentanyl group had 25%, 20%, 20% patients with minimal, moderate and severe cough respectively and 3.3% had laryngospasm. Dexmedetomidine group 10%, 5% patients with minimal and moderate cough respectively [14].

Barkha Bindu *et al.*, observed in their study that the quality of extubation was better in the dexmedetomidine group. 84 % patients in the group dexmedetomidine, had minimal cough, whereas 16% patients hadmoderate cough during extubation. In the placebo group, 84% patients had

moderate cough during extubation, whereas only 16% patients had minimal cough [15].

On comparing mean systolic blood pressure between two groups at 1,5 and 10 minute after extubation highly significant difference were found between two groups (p<.001). Barkha Bindu *et al.* compared the effects of dexmedetomidine with placebo in fifty patients. A statistically significant difference was observed in systolic blood pressure between the two groups (p<.05) from 10 minutes after start of administration of the drug abd continued till the time observations were made [15].

In the present study, the quality of extubation is better with Dexmedetomidine when compared with fentanyl which is in concurrence with the above studies. Dexmedetomidine 0.5 µg/kg IV before tracheal extubation was associated with significantly less coughing and better quality of extubation than was fentanyl.

In the present study, no significant difference was found in sedation scores between group D and group F.R. Amutharani *et al.* found in their study that the Ramsay sedation score during initial 25 minutes post-operatively among Dexmedetomidine (0.5µg/kg) group with the other groups, fentanyl (1µg/kg) and normal saline produced a P value of 0.199, which was statistically insignificant [16]. R. Aksu *et al.*, found that there were no significant differences in postoperative sedation scores between the dexmedetomidine and fentanyl group [14].

Conclusion

Dexmedetomidine administered before tracheal extubation, was more effective in maintaining the haemodynamic stability, facilitated smooth tracheal extubation and had a better quality of recovery as compared to fentanyl. Dexmedetomidine enables smooth extubation of the trachea and provides adequate sedation postoperatively.

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