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Original Research Article

Comparison of Hemodynamic Effects Between Dexmedetomidine - Propofol and Fentanyl - Propofol Groups for Laryngeal Mask Airway Insertion

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Conflict of interest: Nil

Abstract:

Background: Laryngeal mask airway (LMA) is a non invasive supraglottic device which has led to radical change in general anaesthesia. LMA has the advantage of being less stimulating than the tracheal intubation as visualisation of cords and entry into larynx is not required. Propofol is the most commonly used induction agent for LMA insertion due to its depressant action on upper airway reflexes. Opioids like fentanyl are added which reduce the effective concentration for LMA insertion of propofol for various noxious stimuli with minimal respiratory depression. Dexmedetomidine is a good anesthetic adjuvant that decreases the requirement of propofol and maintains stable hemodynamics intraoperatively.

Aims and Objectives: To study and compare the Hemodynamic effects between dexmedetomidine - propofol and fentanyl - propofol groups.

Materials and Methods: A total of 60 patients belonging to American Society of Anaesthesiologist Grade 1 & 2, age varying from 20 to 60 years of either sex scheduled for short elective surgical procedures were randomly divided into 2 groups of 30 patients each (Group D and Group F). In Group D, dexmedetomidine 1mcg/kg diluted in 100 ml normal saline was given over 10 minutes. 30seconds later propofol 2mg/kg was given for induction without neuromuscular blocking agents. In Group F, fentanyl 2 mcg/kg diluted in 100 ml normal saline was given over 10 minutes. 30seconds later propofol 2mg/kg was given for induction without neuromuscular blocking agents. LMA was inserted after 60 seconds of injection of propofol.

Parameters observed are Heart rate, Respiratory rate, Non invasive blood pressure (SBP & DBP), Oxygen saturation and adverse effects were noted.

Results: In our study, the fall in systolic BP, diastolic BP and heart rate was more in. dexmedetomidine group but fall in respiratory rate was more in fentanyl group. Apnoea time was longer in fentanyl group compared to dexmedetomidine group. The incidence of bradycardia, hypotension was higher in dexmedetomidine group than fentanyl group.

Conclusion: Dexmedetomidine group had less respiratory depression and more stable haemodynamics compared to fentanyl group when used along with propofol for insertion of LMA.

Keywords: Laryngeal mask airway (LMA), Dexmedetomidine, Fentanyl, Propofol.

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Introduction

Airway management is one of the most important skills in the field of anaesthesiology and inability to secure the airway can lead to catastrophic results. Laryngeal mask airway (LMA). is a non-invasive supraglottic device, with a lumen that provides a seal around the laryngeal inlet. It has the advantage of being less stimulating than the tracheal intubation as visualisation of cords and entry into larynx is not required. With LMA there is ease of insertion without laryngoscope or muscle relaxant. [1]

Inadequate depth of anaesthesia may provoke coughing, gagging and laryngospasm which may lead to adverse haemodynamic changes. Therefore, the optimal condition for LMA insertion mandates a generous use of anaesthetic agent for induction.

Propofol is the most commonly used induction agent for LMA insertion due to its depressant action on upper airway reflexes [2] . When used alone without premedication, propofol provides conditions for LMA insertion that is far from satisfactory and causes cardiorespiratory depression**.**

As propofol itself does not have any analgesic property, opioids are added which reduce the

effective concentration (EC_{50LMA}) for LMA insertion of propofol for various noxious stimuli with minimal respiratory depression [3]. Here fentanyl is the opioid of choice. Although in general, incremental doses of fentanyl depress the airway reflex responses in a dose related manner, a small dose does not effectively prevent laryngospasm when normocapnia is maintained [4].

Dexmedetomidine is a pharmacologically active dextromer of medetomidine and a selective alpha-2 receptor agonist activity. It has sedative and analgesic activity without causing post operative respiratory depression. Also, dexmedetomidine is said to be a good anesthetic adjuvant that decreases the requirement of propofol and maintains stable hemodynamics intraoperatively [5].

Thus in our present study, we intend to compare the Hemodynamic effects during LMA insertion by using dexmedetomidine with propofol and fentanyl with propofol combination. Since such combination has not been studied in our institute in the past.

Method of Study

Study design: Prospective interventional study.

Duration of study: 18 months, from 1 October 2019 to 31st March 2021.

Sample size: 60 patients, divided into two groups as Group D and F, of 30 patients each.

Sampling procedure: Simple random sampling.

This study done at M.R. Medical College, Kalaburagi.

Inclusion Criteria:

1. Age between 20 to 60 yrs of either sex.
2. American society of anaesthesiologists (ASA) grade I & II.
3. Weight 35-70 kgs.
4. Patients scheduled to undergo elective surgical procedures.

Exclusion Criteria:

1. Patient with hyper reactive airways.
2. Known egg allergy.
3. Patients undergoing oral surgeries.
4. Patients with neck and facial burns.

Methods

All patients who are in inclusion criteria was assessed by pre anaesthetic examination.

Data was collected in prescribed proforma meeting the objectives of the study.

Patients were randomly allocated into two groups : Group D and Group F of 30 patients each.

All the LMA insertions were made with classic LMA with standard insertion technique. Size of the LMA to be used in each patient was determined according to their weight. On the day of surgery, after 8 hours of fasting, patients were shifted to the operating room and monitors were connected. Baseline vitals of the patients like NIBP, RR, Pulse rate and SPO2 were noted. All the patients were premedicated with Inj. Glycopyrrolate 0.005mg/kg IV and Inj. Ondansetran 4 mg IV 30 minutes before surgery.

In group D or dexmedetomidine-propofol group, the patients were pre- oxygenated for 3minutes and dexmedetomidine 1mcg/kg diluted in 100 ml normal saline was given over 10minutes. 30seconds later propofol 2mg/kg was given for induction without neuromuscular blocking agents.

In group F or fentanyl – propofol group the patients were preoxygenated for 3 minutes and fentanyl 2 mcg/kg diluted in 100 ml normal saline was given over 10minutes. 30seconds later propofol 2mg/kg was given for induction without neuromuscular blocking agents.

LMA was inserted after 60seconds of injection of propofol by an anaesthesiologist who was unaware of induction and adjuvant anaesthetic agents.

After successful placement of LMA and confirming its placement, patients were kept on spontaneous ventilation. Anaesthesia was maintained with isoflurane, nitrous oxide, oxygen.

At the completion of surgery isoflurane, nitrous oxide was stopped and LMA was removed. 100% oxygen was given via face mask till recovery.

Parameters observed will be:

Apnoea time: The time from last spontaneous breath after propofol administration to first spontaneous breath was recorded.

Heart rate, Respiratory rate, Non-invasive blood pressure and Oxygen saturation was recorded before induction i.e. Baseline, 30 seconds,1 minute, 2 minute, 3 minutes, 4 minutes, 5 minutes,10 minutes,15 minutes and 20 minutes after induction.

Any adverse effects were noted. Heart rate less than 45 per min and fall in blood pressure more than 20% from the baseline value was considered bradycardia and hypotension respectively. Bradycardia and hypotension were treated with Inj. Atropine 0.6 mg IV and Inj. Mephentermine 6 mg IV bolus respectively.

Informed consent: Informed consent was taken in the patients own vernacular language.

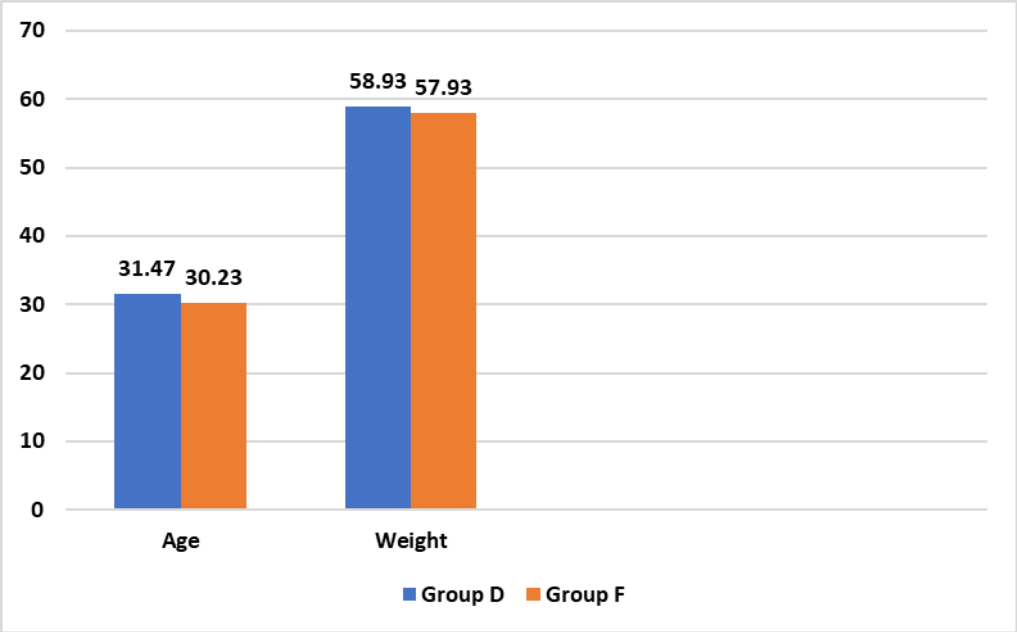
Statistical Data Analysis: Statistical analysis will be analysed by using IBM SPSS 20.00 version software. For qualitative data analysis, Chi-square test will be used and for quantitative data analysis, unpaired t test will be applied and for statistical

significance if p value is <0.05 is considered as significant.

Observation and Results

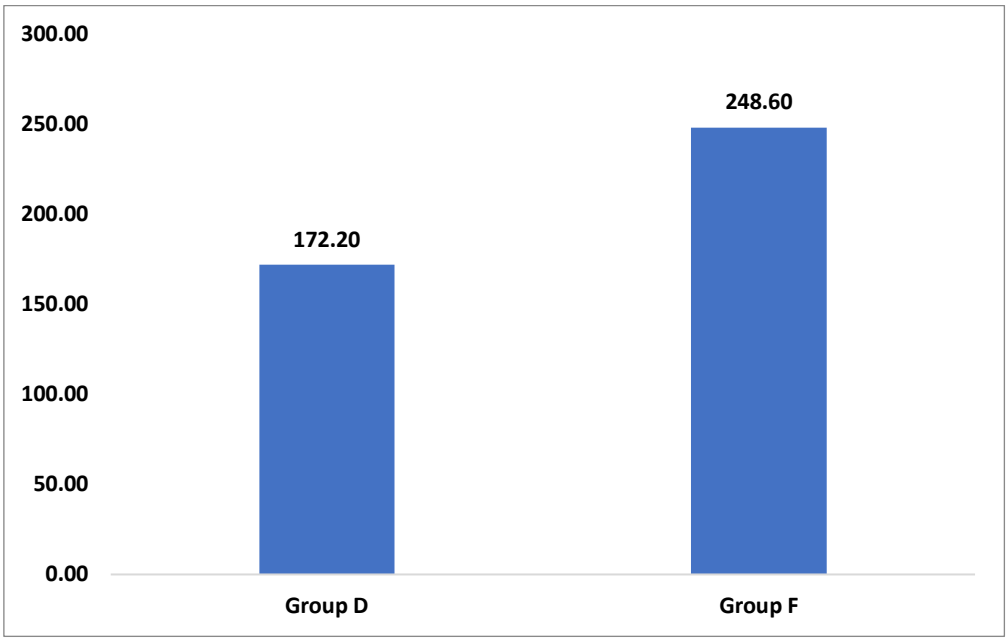
Table 1: Demographic data and duration of apnoea

Variable	Group D	Group F	p value- Student t test
Age	31.47(±7.56)	30.23(±7.79)	0.54
Weight	58.93(±5.25)	57.93(±6.15)	0.50
Duration of apnoea	172.2(±16.78)	248.6(±17.12)	**0.00**



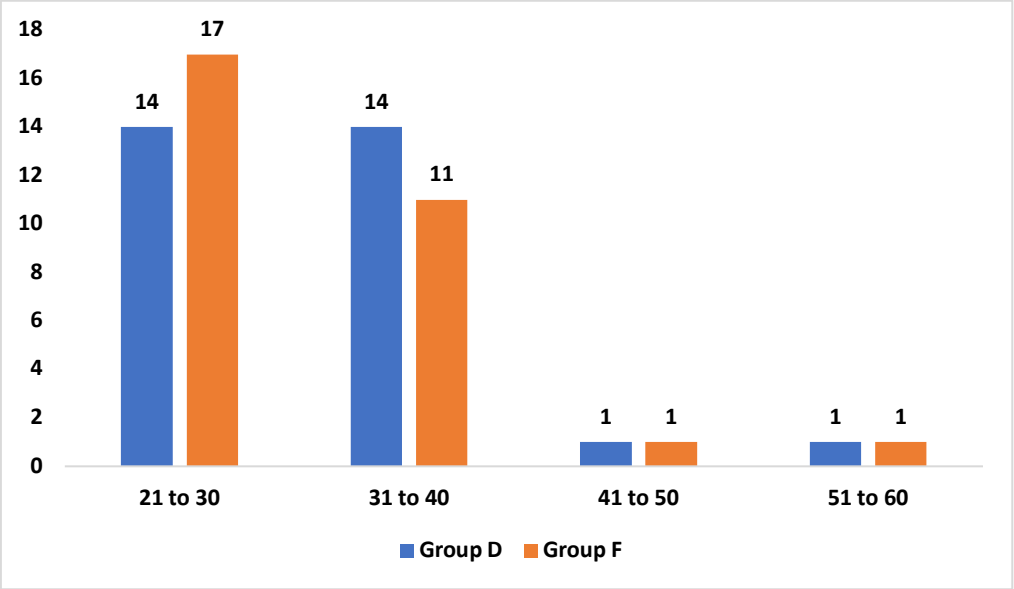
Graph 1: Bar diaphragm represents demographic data

Demographic data like age, weight was comparable in both the groups with p value > 0.05.



Graph 2: Bar diaphragm represents duration of apnoea

The duration of apnoea is longer in fentanyl group (248.6s) when compared to dexmedetomidine group (172.2s) which is statistically significant (p value <0.05).

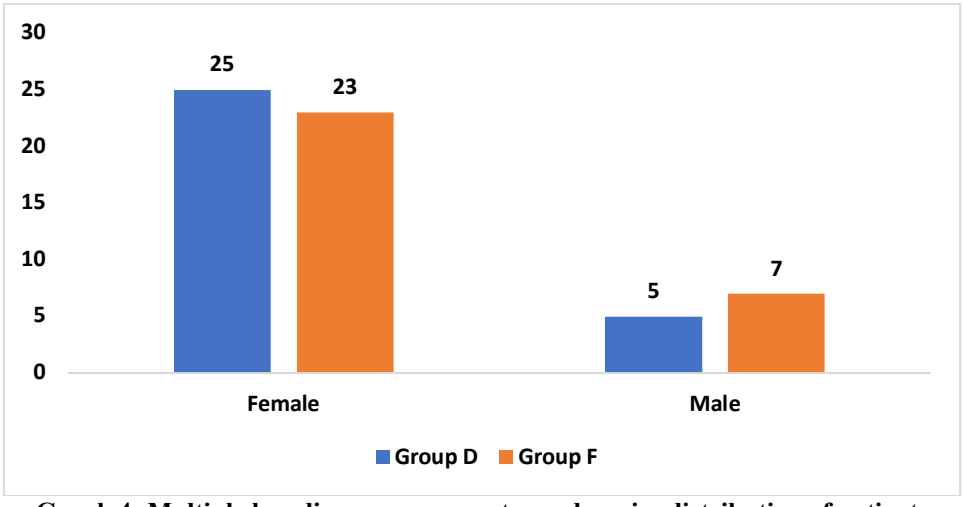


Graph 3: Multiple bar diagram represents Age wise distribution of patients

Table 2: Age wise distribution of patients

Age in years	Groups		Total	p value
	Group D	Group F		
21 to 30	14(46.67%)	17(56.67%)	31(51.67%)	0.885
31 to 40	14(46.67%)	11(36.67%)	25(41.67%)	Chi square
41 to 50	1(3.33%)	1(3.33%)	2(3.33%)	
51 to 60	1(3.33%)	1(3.33%)	2(3.33%)	
Total	30(100%)	30(100%)	60(100%)	

Study observes that maximum number of patients in both groups were 31 cases (51.67%) belongs to age group of 21 to 30 followed by 25 cases (41.67%) which belongs to age group 31 to 40 and least number of cases (3.33%) were in age group 41 to 50 and 51 to 60. There was no statistically significant difference in distribution of age in both the groups.

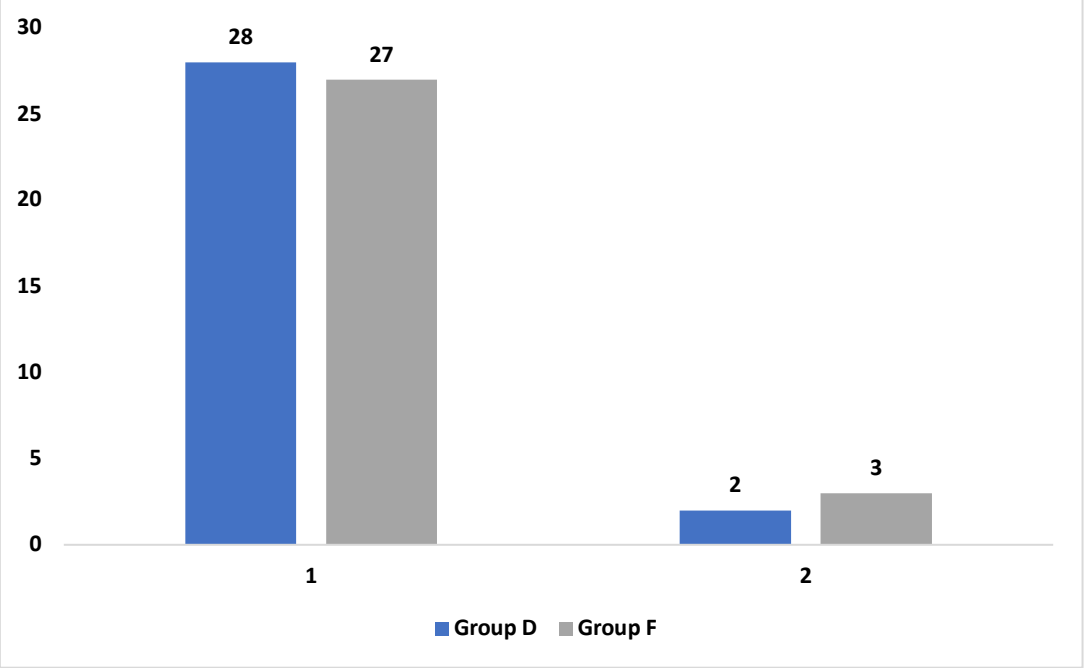


Graph 4: Multiple bar diagram represents gender wise distribution of patients

Table 3: Sex wise distribution of patients

Sex	Groups		Total	p value
	Group D	Group F		
Female	25(83.33%)	23(76.67%)	48(80%)	0.519
Male	5(16.67%)	7(23.33%)	12(20%)	Chi square
Total	30(100%)	30(100%)	60(100%)	

In my Study, maximum number of patients were females in both the groups. In group D, 83.3 % were females and 16.67% were males. In group F, 76.7 % were females and 23.33% were males. There was no statistically significant difference in distribution of sex in both the groups.

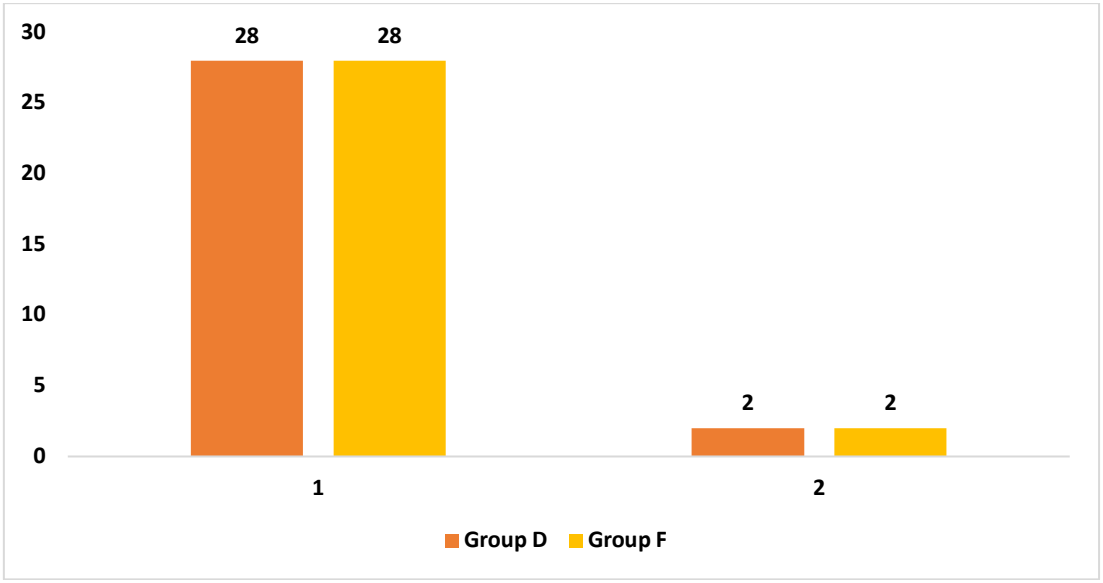


Graph 5: Multiple bar diagram represents ASA Grade wise distribution of patients

Table 4: ASA Grades wise distribution of patients

ASA	Groups		Total	p value
	Group D	Group F		
1	28(93.33%)	27(90%)	55(91.67%)	1
2	2(6.67%)	3(10%)	5(8.33%)	Fishers exact
Total	30(100%)	30(100%)	60(100%)	

In group D, 28 patients (93.33%) and in group F, 27 patients (90%) had ASA grade 1 whereas 3 patients had ASA grade 2 in Group F and 2 patients in group D. There was no statistically significance in ASA distribution between two groups.

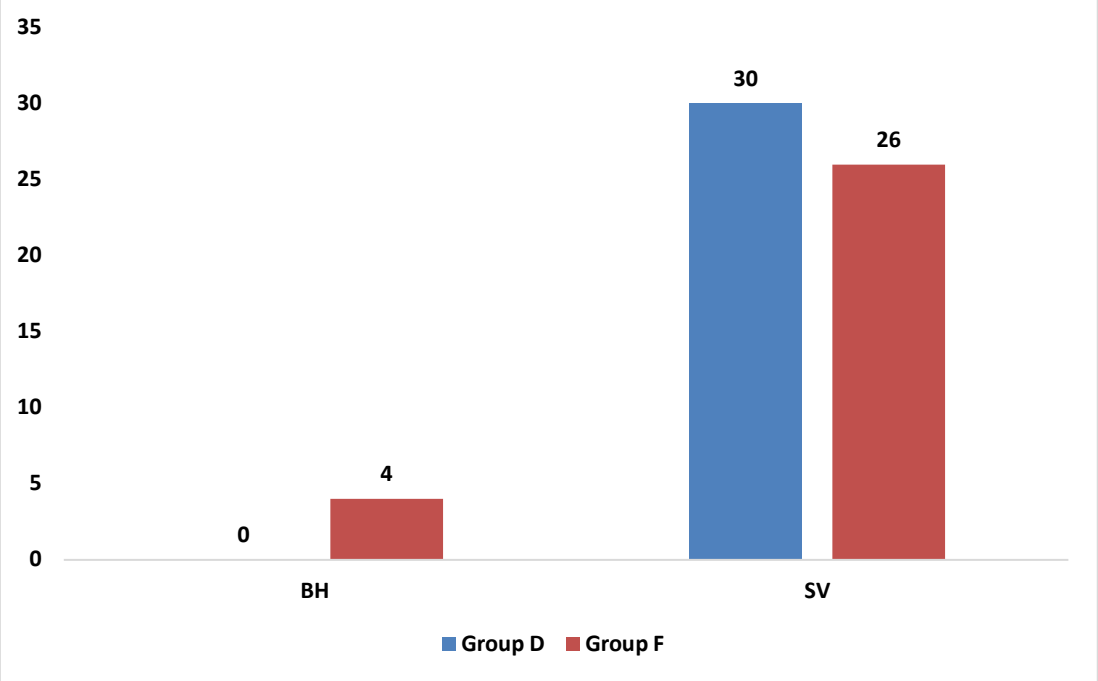


Graph 6 : Multiple bar diagram represents MPC Grade wise distribution of patients

Table 5: MPC Grades wise distribution of patients

MPC	Groups		Total	p value
	Group D	Group F		
1	28(93.33%)	28(93.33%)	56(93.33%)	1
2	2(6.67%)	2(6.67%)	4(6.67%)	Fishers exact
Total	30(100%)	30(100%)	60(100%)	

In this study maximum number of patients, 56 (93.33%) belongs to MPC Grade 1 in both the groups. There was no statistically significant difference in distribution of MPC between two groups.



Graph 7: Bar diagram represents distribution of other events in both groups

Table 6: Distribution of other events in both groups

Other events	Groups		Total	p value
	Group D	Group F		
BH	0(0%)	4(13.33%)	4(6.67%)	0.112
SV	30(100%)	26(86.67%)	56(93.33%)	Fishers exact
Total	30(100%)	30(100%)	60(100%)	

In this study maximum number of patients, 56 (93.33%) had spontaneous ventilation in both the groups. In group D 30 patients (100%) had spontaneous ventilation whereas in group F 26(86.67%) patients had spontaneous ventilation. Breath holding was seen in four patients (13.33%) of fentanyl group. There was no statistically significant difference in distribution of other events between two groups as p value is 0.112.

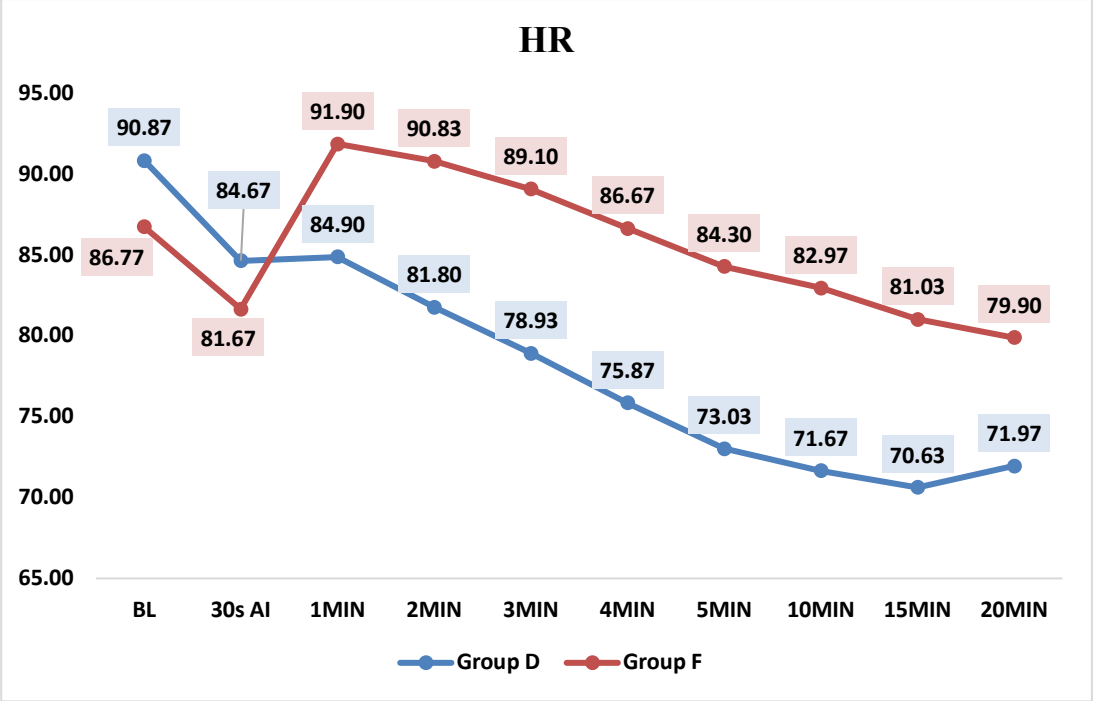


Figure 1: Line diagram represents Comparison of Heart rate (bpm) in two groups of patients

Table 7: Comparison of Heart rate (bpm) between the Groups

Variable	Group D	Group F	p value- Student t test
HR BL	90.87(±4.56)	86.77(±4.97)	**0.00**
HR 30s AI	84.67(±4.59)	81.67(±5.03)	**0.02**
HR 1MIN	84.9(±3.67)	91.9(±4.09)	**0.00**
HR 2MIN	81.8(±4.02)	90.83(±3.75)	**0.00**
HR 3MIN	78.93(±4.85)	89.1(±4.47)	**0.00**
HR 4MIN	75.87(±5.93)	86.67(±4.36)	**0.00**
HR 5MIN	73.03(±6.95)	84.3(±3.95)	**0.00**
HR 10MIN	71.67(±6.84)	82.97(±4.42)	**0.00**
HR 15MIN	70.63(±8.16)	81.03(±4.44)	**0.00**
HR 20MIN	71.97(±5.68)	79.9(±4.72)	**0.00**

The heart rate was decreased in both study groups from baseline after induction but there was transient rise in heart rate during LMA insertion followed by decrease in heart rate in both the groups which was statistically significant (p value <0.05) in post LMA period starting from 1 min till the end of 20 minutes . The rise in heart rate was higher in fentanyl group when compared to dexmedetomidine group with p value <0.05 which was statistically significant.

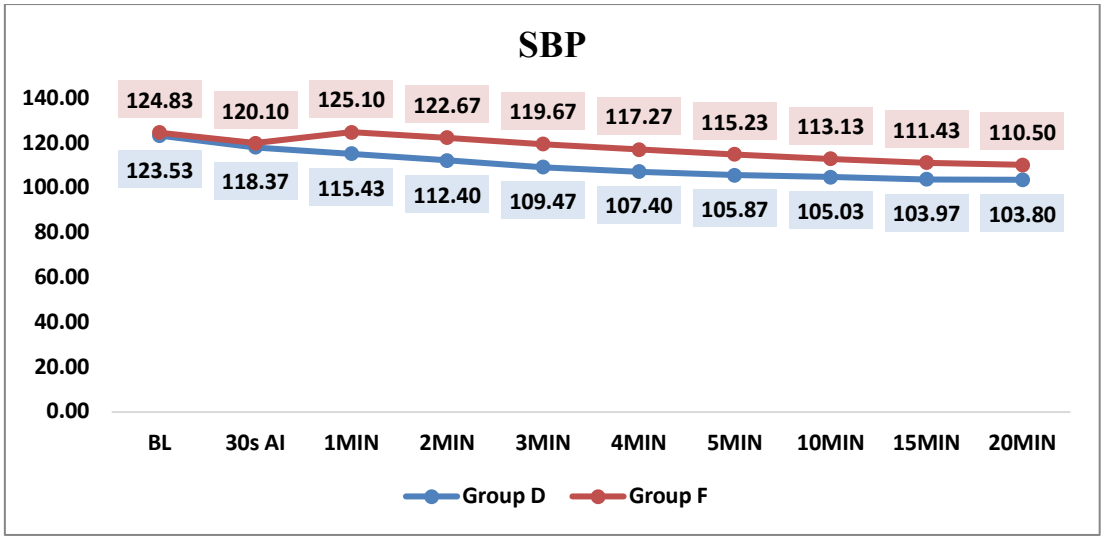


Figure 2 : Line diagram represents comparison of systolic blood pressure between the groups

Table 8: Comparison of systolic blood pressure between the Groups

Variable	Group D	Group F	p value- Student t test
SBP BL	123.53(±4.21)	124.83(±4.64)	0.26
SBP 30s AI	118.37(±3.57)	120.1(±5.1)	0.13
SBP 1MIN	115.43(±3.36)	125.1(±6.39)	**0.00**
SBP 2MIN	112.4(±3.78)	122.67(±6.21)	**0.00**
SBP 3MIN	109.47(±4.46)	119.67(±6.05)	**0.00**
SBP 4MIN	107.4(±4.01)	117.27(±6.55)	**0.00**
SBP 5MIN	105.87(±3.63)	115.23(±5.47)	**0.00**
SBP 10MIN	105.03(±2.65)	113.13(±5.06)	**0.00**
SBP 15MIN	103.97(±3.71)	111.43(±4.72)	**0.00**
SBP 20MIN	103.8(±4.33)	110.5(±4.65)	**0.00**

In Group D ,there is decreasing trend in systolic blood pressure when compared to baseline till 20 minutes of post insertion of LMA .In group F there is increase in systolic blood pressure when compared to baseline after insertion of LMA (1 minute) followed by decrease in SBP upto 20 minutes of post LMA insertion where as in group D there is no such increase in DBP.

Statistically significant decrease in systolic blood pressure was seen in both the groups but there was more fall in SBP in group D compared to group F, in post LMA period starting from 1 min till the end of 20 minutes with p value < 0.05 which was statistically significant.

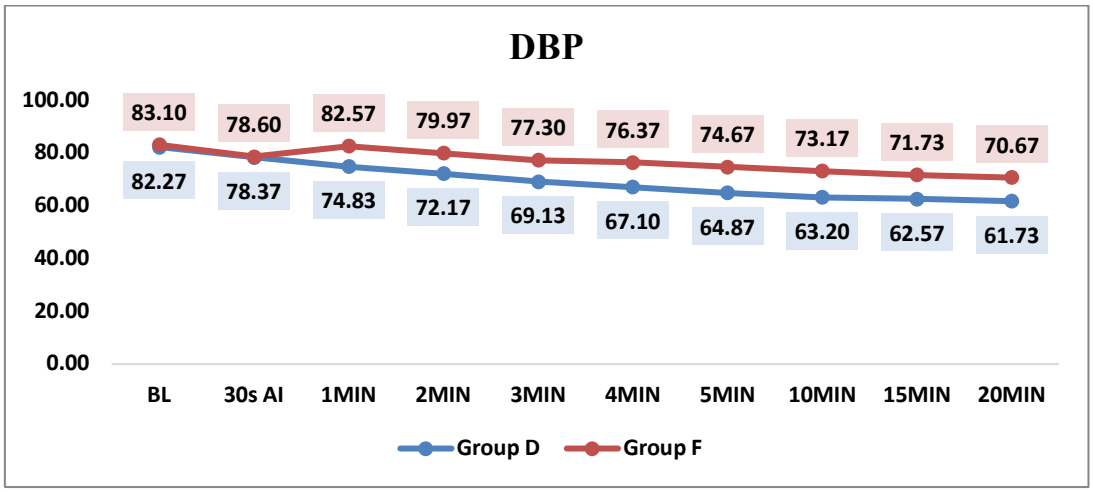


Figure 3: Line diagram represents comparison of diastolic blood pressure between the groups

Table 9: Comparison of Diastolic blood pressure between the Groups

Variable	Group D	Group F	p value- Student t test
DBP BL	82.27(±5.3)	83.1(±5.01)	**0.53**
DBP 30s AI	78.37(±5.2)	78.6(±6.9)	**0.88**
DBP 1MIN	74.83(±5.75)	82.57(±7.37)	**0.00**
DBP 2MIN	72.17(±6.34)	79.97(±6.82)	**0.00**
DBP 3MIN	69.13(±6.75)	77.3(±7)	**0.00**
DBP 4MIN	67.1(±6.17)	76.37(±7.52)	**0.00**
DBP 5MIN	64.87(±5.59)	74.67(±6.59)	**0.00**
DBP 10MIN	63.2(±4.23)	73.17(±6.3)	**0.00**
DBP 15MIN	62.57(±4.54)	71.73(±6.63)	**0.00**
DBP 20MIN	61.73(±4.75)	70.67(±5.58)	**0.00**

Diastolic blood pressure of the group D showed decreasing trend similar to that of systolic blood pressure till 20 minutes post insertion of LMA .In group F there was increase in systolic blood pressure when compared to baseline after insertion of LMA (1 minute) followed by decrease in DBP upto 20 minutes of post LMA insertion where as in group D there was no such increase in DBP.

Statistically significant decrease in systolic blood pressure was seen in both the groups but there was more fall in DBP in group D compared to group F in post LMA period starting from 1 min till the end of 20 minutes with p value < 0.05 which was statistically significant.

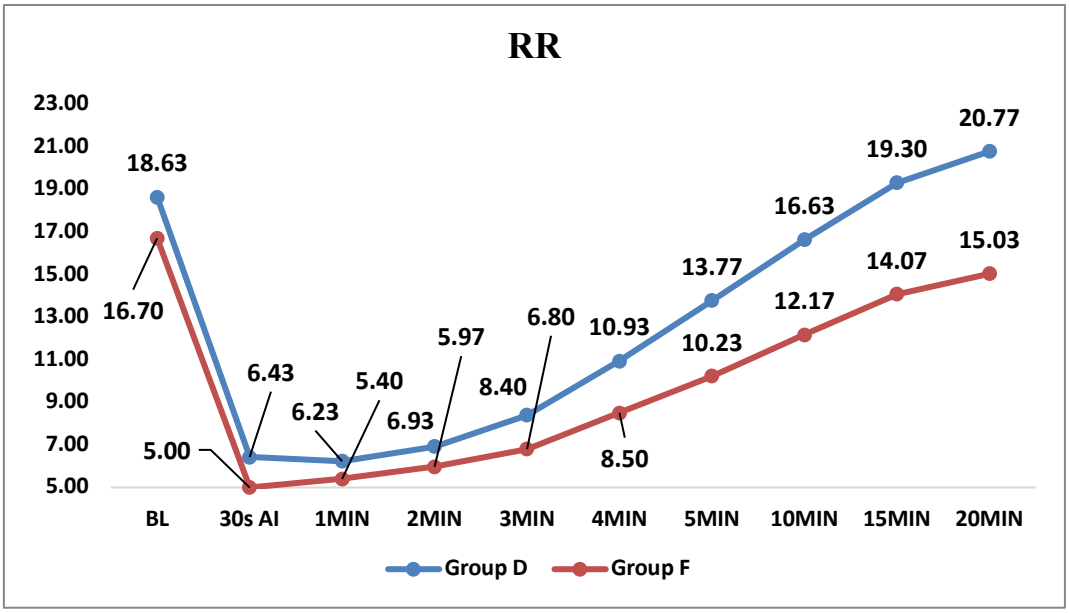


Figure 4: Line diagram represents comparison of respiratory rate between the groups

Table 10: Comparison of respiratory rate between the groups

Variable	Group D	Group F	p value- Student t test
RR BL	18.63(±2.47)	16.7(±2.44)	**0.00**
RR 30s AI	6.43(±0.63)	5(±0.79)	**0.00**
RR 1MIN	6.23(±0.97)	5.4(±0.77)	**0.00**
RR 2MIN	6.93(±1.23)	5.97(±0.89)	**0.00**
RR 3MIN	8.4(±1.5)	6.8(±1.1)	**0.00**
RR 4MIN	10.93(±1.82)	8.5(±1.25)	**0.00**
RR 5MIN	13.77(±1.85)	10.23(±1.07)	**0.00**
RR 10MIN	16.63(±1.63)	12.17(±1.42)	**0.00**
RR 15MIN	19.3(±1.8)	14.07(±1.26)	**0.00**
RR 20MIN	20.77(±1.3)	15.03(±1.33)	**0.00**

The mean basal RR were comparable in both the groups . There was fall in respiratory rate in both the groups after induction which was more in fentanyl group compared to dexmedetomidine group

followed by significant increase in RR after insertion of LMA in both groups till the period of 20 minutes. Increase in RR after insertion of LMA was more in group D compared to group F with p value < 0.05 which was statistically significant.

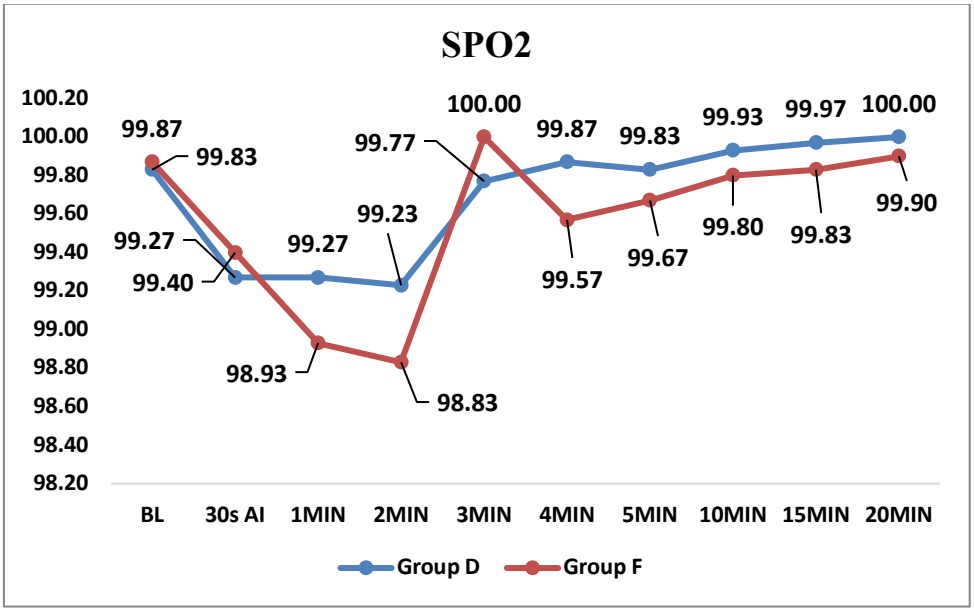
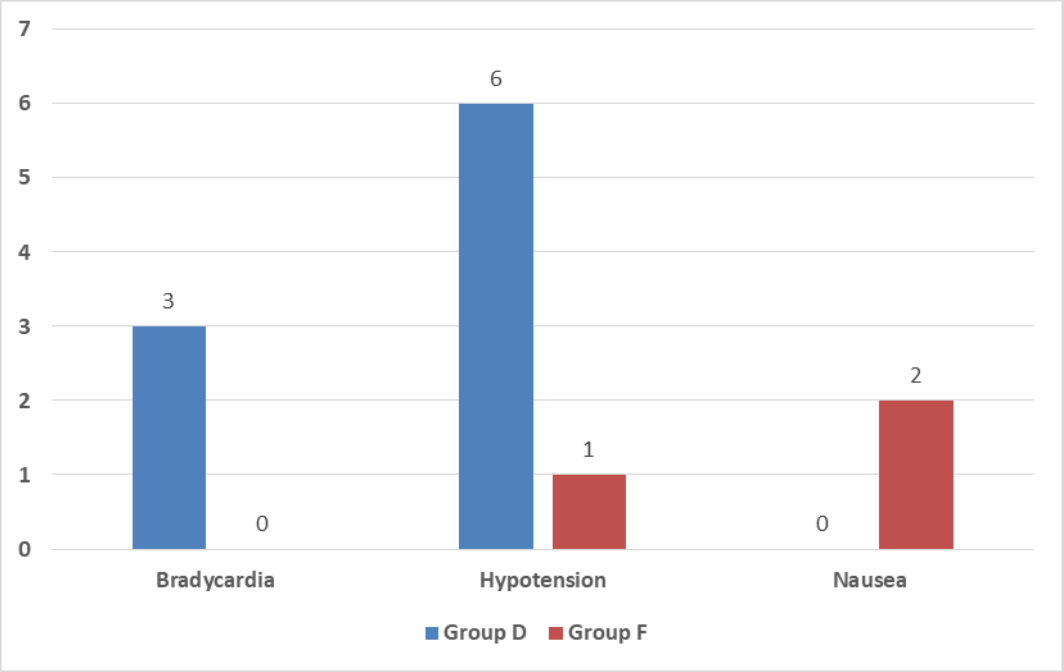


Figure 5 : Line diagram represents comparison of SPO2 between the groups

Table 11: Comparison of saturation (SpO2) between the groups

Variable	Group D	Group F	p value- Student t test
SPO2 BL	99.83(±0.38)	99.87(±0.43)	0.75
SPO2 30s AI	99.27(±0.64)	99.4(±1)	0.54
SPO2 1MIN	99.27(±0.69)	98.93(±0.74)	0.08
SPO2 2MIN	99.23(±0.68)	98.83(±0.95)	0.07
SPO2 3MIN	99.77(±0.43)	100(±0)	**0.00**
SPO2 4MIN	99.87(±0.35)	99.57(±0.57)	**0.02**
SPO2 5MIN	99.83(±0.38)	99.67(±0.55)	0.18
SPO2 10MIN	99.93(±0.25)	99.8(±0.41)	0.13
SPO2 15MIN	99.97(±0.18)	99.83(±0.38)	0.09
SPO2 20MIN	100(±0)	99.9(±0.31)	0.08



Graph 8: Bar diagram represents distribution of adverse effects in both groups

Table 12: Comparison of adverse effects between the groups

Adverse effects	Groups		Total	p value
	Group D	Group F		
Bradycardia	3(10%)	0(0%)	3(5%)	**0.025**
Hypotension	6(20%)	1(3.33%)	7(11.67%)	Chi square
Nausea	0(0%)	2(6.67%)	2(3.33%)	
Total	30(100%)	30(100%)	60(100%)	

Bradycardia was noted in 3 patients (10%) in the Group D compared to group F whereas hypotension was seen in 6 pateints (20%) in Group D and only 1 patient (3.33%) had hypotension in Group F. 2 patients (6.67%) had nausea in Group F. Other adverse effects like shivering, vomiting and laryngospasm was not seen in any group. There was statistically significant difference in adverse effects between two groups as p value is 0.025.

Discussion

LMA has gained wide acceptance for routine airway management, difficult airway and in emergency situation. Safe insertion of LMA requires deep levels of anesthesia with suppression of airway reflexes. [2]

In the past, volatile anaesthetics such as sevoflurane and thiopentone were commonly used as induction agents for LMA insertion. Nowadays, Propofol is most commonly used induction drug for LMA insertion.

Propofol at higher doses can cause significant hypotension, bradycardia and respiratory depression. As a result, opioids or other anaesthetic drugs were used as an adjuvant to propofol in attempt to reduce the dose of propofol and hence the cardiopulmonary system suppression caused by propofol. Opioids increases the incidence and duration of apnoea and many newer drugs are being studied to achieve optimal insertion conditions for LMA with fewer side effects.

Dexmedetomidine is a highly selective alpha 2 agonist with sedative, analgesic, and sympatholytic characteristics. In my study, dexmedetomidine was evaluated in terms of hemodynamic stability for LMA insertion and has been compared to fentanyl propofol combination.

In our study, dose of fentanyl used was 2 mcg/kg, and that was based on a study conducted by Goyagi et al [6] in 41 healthy patients, who found out that pre-administration of fentanyl 2 mcg/kg reduces the requirement of propofol for LMA insertion.

The dose of dexmedetomidine used in my study was 1mcg/kg, and it was based on a study done by Uzümcügil et al [7], which had 52 patients undergoing minor urological procedures. He found that dexmedetomidine 1mcg/kg coadministered with propofol 1.5mg/kg provides successful LMA insertion.

The dose of propofol used in my study was 2mg/kg, we found out that insertion conditions for LMA was better and successful whereas study conducted by Blake et al [8] who studied four different propofol

induction doses (1.5-2.5mg/kg) and they evaluated that a dose of 1.5 mg/kg iv propofol was not optimum for LMA insertion. Hence we considered using 2 mg/kg iv propofol for LMA insertion.

Wong CM [9] et al found that a standard fentanyl dose of 1μ/kg co-administered with propofol 2.5mg/kg, provided optimal conditions in only 65% of cases and reported a higher incidence of resistance to mouth opening with use of fentanyl. However in our study, we have used 2mg/kg propofol with 2 μ/kg fentanyl for LMA insertion.

In our study, in fentanyl group we found a significant rise in SBP and DBP after LMA insertion (1 minute) which was not seen in dexmedetomidine group followed by significant fall in SBP and DBP was seen in both the groups but fall was more in group D in post LMA period starting from 1 min till the end of 20 minutes , though in study done by Uzumcugil F et al [7] they found no difference in SBP and DBP between dexmedetomidine and fentanyl. As against the results of this study, there was no rise in blood pressure in dexmedetomidine group in our study.

In present study, there was transient rise in heart rate during LMA insertion till 1 minute followed by decrease in heart rate in both the groups till the end of 20 minutes. The rise in HR was more in group F than group D in post LMA period starting from 1 min till the end of 20 minutes. The results of my study was comparable to Shalaka Sandeep Nellore et al [10] in which the heart rate was decreased in both study groups from baseline after their infusion but there was a transient rise in heart rate during LMA insertion.

The mean basal RR were comparable in both the groups. In present study there was fall in respiratory rate in both the groups after induction which was more in fentanyl group compared to dexmedetomidine group followed by significant increase in RR after insertion of LMA in both groups till the period of 20 minutes. Increase in RR was more in dexmedetomidine group than fentanyl group and the increase in respiratory rate was mild. Results of my study supported by A H ramaswamy et al [11] in which there was increase in the RR in Group D compared to group F.

In my study, respiration was better preserved in the dexmedetomidine group than fentanyl group. The duration of apnoea was significantly, higher in group F. The significantly longer apnoea times in group F compared to group D could be because fentanyl caused more respiratory depression than dexmedetomidine, when given along with propofol. Our results were similar to the study done by Uzümcügil et al. [7] with respect to changes in respiration.

The incidence of bradycardia was more in group D when compared to group F . In group D,4 patients were treated with Inj. atropine 0.6mg IV and no patients in group F received Inj. atropine .In the group D, 6 patients were treated with Inj. mephentermine 6mg IV while in the group F, 1 patient required Inj. mephentermine for hypotension. 2 patients had nausea in fentantyl group which was treated with inj ondansetron 4mg IV. Thus the incidence of bradycardia, hypotension were higher in group D while nausea was higher in group F and adverse effects were treated. None of the patients in either group D or F developed laryngospasm, vomiting and shivering in our study. Study done by Bindu et al [12] in which dexmedetomidine group had 13 cases of hypotension ,2 cases of bradycardia and none of the patients in fentanyl group developed adverse effects.

Our study showed that dexmedetomidine had less respiratory depression and more stable haemodynamics than that of fentanyl when used along with propofol for insertion of LMA. More than attenuation of pressor responses to LMA insertion, dexmedetomidine at the dose of 1 mcg/kg produces significant bradycardia and hypotension necessitating use of vasopressors.

Conclusion

Dexmedetomidine provides better attenuation of pressor response to LMA insertion with less respiratory depression .It also provides more stable haemodynamics, with less adverse effects than fentanyl when used along with propofol for insertion of LMA.

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