

## Evaluate the efficacy of Intravenous Clonidine and Dexmedetomidine on Haemodynamic stress response during Pneumoperitoneum in Laparoscopic Cholecystectomy Surgeries

**Dr. Gurpreet Singh, Dr. Jasneet Singh, Dr. Devika Gupta**

MBBS, DNB(Anesthesiology), Senior Resident, Department of Anesthesiology and Critical Care, Janakpuri Super Speciality Hospital, Janakpuri, 110058, New Delhi

MBBS, Senior Resident, Department of Cardiology, Janakpuri Super Speciality Hospital, Janakpuri, 110058 New Delhi

MBBS, Junior Resident, Janakpuri Super Speciality Hospital, Janakpuri, 110058, New Delhi.

### Abstract

**Background:** This study is designed to compare the beneficial effect of the two  $\alpha$ -2 agonists namely clonidine and dexmedetomidine in maintaining the perioperative haemodynamic parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) during pneumoperitoneum in laparoscopic cholecystectomy and to identify a better drug in attenuating these haemodynamic responses.

**Methodology:** The study group included ninety ASA grade I and II patients, aged between 20 to 50 years, belonging to either sex, scheduled for elective laparoscopic cholecystectomy under general anesthesia in the operation room of the institute.

Group A (n=30) received 50 ml normal saline over a period of 10 minutes after induction and before pneumoperitoneum (PNP), followed by a continuous slow infusion at the rate of 0.5 ml/kg/hr. Group B (n=30) Clonidine 2 $\mu$ g/kg in 50ml normal saline over a period of 10 minutes after induction and before PNP, followed by a continuous infusion at the rate of 0.5 ml/kg/hr (2  $\mu$ g/kg/hr). Group C (n=30) Clonidine 2 $\mu$ g/kg in 50ml normal saline over a period of 10 minutes after induction and before PNP, followed by a continuous infusion at the rate of 0.5 ml/kg/hr (2  $\mu$ g/kg/hr).

**Results:** Rise in heart rate were statistically insignificant in all the groups at baseline(B) and just after induction (D0). After infusion of drugs, rise in heart rate were significantly lower in all the intervals in Clonidine group and Dexmedetomidine group comparing with Control group. While comparing Clonidine with Dexmedetomidine, significantly lower heart rate were observed in dexmedetomidine group. On inter-group statistical analysis statistically significant decrease in SBP, DBP and MAP were observed at all the intervals in clonidine and dexmedetomidine group except at baseline (B), (D0) on comparison with Control group. While comparing Dexmedetomidine group with clonidine group, insignificant decrease (p>0.05) in SBP and MAP were observed at all intervals except at 50 minutes after pneumoperitoneum (APN50). On comparing dexmedetomidine group with clonidine group, insignificant decrease (p>0.05) in DBP were observed at all intervals except at 30 minutes after pneumoperitoneum (APN30) and after reversal (DBP\_AR). On inter-group statistical analysis of sedation score after extubation, there was significantly higher sedation (score 3 and 4) (p<0.05) seen in Dexmedetomidine group on comparing with Control group and Clonidine group, whereas on comparing Clonidine group with Control group higher sedation was observed in Clonidine group.

**Conclusion:** Creation of pneumoperitoneum in laparoscopic abdominal surgeries produces significant increase of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP). Both intravenous clonidine and intravenous dexmedetomidine cause decrease in all haemodynamic parameters (HR, SBP, DBP and MAP) during pneumoperitoneum in laparoscopic abdominal surgeries. Dexmedetomidine and clonidine are equally effective in controlling blood pressure during pneumoperitoneum in laparoscopic surgeries but heart rate is better controlled by dexmedetomidine.

**Key words:** Clonidine, Dexmedetomidine, Pneumoperitoneum, laparoscopic cholecystectomy.

## Introduction

The laparoscopic approach for both diagnostic and operative surgeries is considered to be safe and reliable technique with several advantages over the standard open procedure.<sup>1,2</sup>Laparoscopic cholecystectomy surgery is one of the most commonly undertaken procedure in general surgery with the overall complication rate being less than 1.5% and the mortality being less than 0.1%.<sup>3</sup>Because of its cosmetically better scar, less postoperative pain, decreased hospital stay and obviously less mortality, it has become the gold standard for treatment of gall stone diseases<sup>4</sup>.

The anaesthesiologist's traditional approach to anaesthesia for laparoscopic cholecystectomy surgeries has been the emphasis on maintaining haemodynamic stability by avoiding hypertension, hypotension or tachycardia. The problem has been more complex than originally thought and most of the haemodynamic instability is persistent during the duration of pneumoperitoneum (PNP)<sup>5-6</sup>namely carbon dioxide (CO<sub>2</sub>) insufflations and patient positioning<sup>7-8</sup>.

CO<sub>2</sub> is the main gas used for insufflations in laparoscopic procedure although gases like helium and air can also be used<sup>9-10</sup>. It also permits the use of electrocoagulation, and is readily absorbed by the peritoneal membrane (blood/gas solubility 0.48) and expired by the lungs. The cardiopulmonary changes occurring during laparoscopy are complex and depend on the interaction of patients pre-existing cardiopulmonary status, the anaesthetic technique (ventilatory technique and anaesthetic agents used), intraabdominal pressure (IAP)<sup>11</sup>, CO<sub>2</sub> absorption, patient's position and duration of the surgical procedure. Insufflation of CO<sub>2</sub> and increased IAP(>10torr) produces significant alterations in haemodynamic parameters characterised by decreased cardiac output, increased arterial pressures, increased systemic vascular resistance (SVR) and pulmonary vascular resistance (PVR)<sup>12-13</sup>. Potential mediators of the increased SVR observed during pneumoperitoneum include release of vasopressin and catecholamines<sup>14</sup>. A decrease in venous return after a transient increase in IAP due to caval compression<sup>15</sup>, pooling of blood and increase in venous resistance. Pneumoperitoneum decreases thoracopulmonary compliance by 30-50%. Reduction in FRC and atelectasis due to elevation of diaphragm and changes in ventilation and perfusion results from increased airway pressure<sup>16</sup>.

Various anaesthetic interventions like use of epidural, segmental spinal, combined epidural and general anaesthesia, controlled increase of intrathoracic blood volume (ITBV) by intravenous fluids and pharmacological methods have been used by anaesthesiologists over the years to prevent or attenuate these adverse haemodynamic changes associated with pneumoperitoneum. Many pharmacological agents like adrenoceptor blockers, beta blockers, Ca channel blocker, lidocaine, opioids, pregabalin, magnesium sulfate, vasodilators, remifentanyl have been used to attenuate these responses with varying success.  $\alpha$ -2 agonist produces diverse responses including analgesia, anxiolysis, sedation and sympatholysis<sup>17</sup>.

Clonidine a centrally acting selective partial  $\alpha$ -2 agonist is known to induce sedation, decrease anaesthetic drug requirement and improvement in perioperative haemodynamic stability by altering blood pressure and heart rate responses to surgical stimulation, and protection against perioperative myocardial ischemia<sup>18</sup>. It provides sympathoadrenal stability and suppresses renin angiotensin activity.

Clonidine inhibits the release of catecholamine and vasopressin, thereby modulates the haemodynamic changes induced by pneumoperitoneum, increases cardiac baroreceptor reflex sensitivity to increase in systolic blood pressure and stabilises blood pressure in patients undergoing laparoscopic cholecystectomy<sup>19</sup>.

Dexmedetomidine is another highly selective and potent specific  $\alpha$ -2 agonist. It is seven to ten times more selective for  $\alpha$ -2 receptors compared to clonidine and has shorter duration of action (6-10 hr Vs 2-3 hr). Similar to clonidine, dexmedetomidine also attenuates the haemodynamic response to tracheal intubation, decrease plasma catecholamine and norepineprine concentration during anaesthesia, decreases perioperative requirements of inhaled anaesthetics. Dexmedetomidine maintains blood pressure and heart rate and reduces the opioid requirements during pneumoperitoneum in laparoscopic surgeries<sup>20</sup>.

Hence this study is designed to compare the beneficial effect of the two  $\alpha$ -2 agonists namely clonidine and dexmedetomidine in maintaining the perioperative haemodynamic parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) during pneumoperitoneum in laparoscopic cholecystectomy and to identify a better drug in attenuating these haemodynamic responses.

## AIM

Aim is to evaluate the efficacy of intravenous clonidine and dexmedetomidine on haemodynamic stress response during pneumoperitoneum in laparoscopic cholecystectomy surgeries.

## OBJECTIVES

1. To study and compare the effects of intravenous clonidine and dexmedetomidine on hemodynamic stress response such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure during pneumoperitoneum in laparoscopic cholecystectomy.
2. To find the better drug between clonidine and dexmedetomidine effective in attenuation of haemodynamic stress response during pneumoperitoneum in laparoscopic cholecystectomy surgeries.
3. To observe any untoward effect of the two study drugs.

## Material & Methods

### Study site

The study was conducted at the Department of Anesthesiology, Mata Chanan Devi Hospital, C-1 Janakpuri, New Delhi, after obtaining approval from the institutional ethical committee and review board and written informed consent from the patients.

### Study population

The study group included ninety ASA grade I and II patients, aged between 20 to 50 years, belonging to either sex, scheduled for elective laparoscopic cholecystectomy under general anesthesia in the operation room of the institute.

Study Design A prospective, randomized, double blind, controlled study

### Inclusion criteria:

- Patients of ASA grade I & II
- Patients between age group of 20 to 50 years of either sex.
- Patients undergoing laparoscopic cholecystectomy

### Exclusion criteria:

Patients with following are excluded from the present study:

- ASA grade III and above.
- BMI >30.
- Patients undergoing intraoperatively.

### Laparoscopic to

### open surgery conversion

- Pneumoperitoneum duration >100 minutes.
- Known history of allergy or sensitivity study drugs or any other reaction to
- Patients with cardiopulmonary and respiratory disorders.
- Patients with hypertension on treatment with beta-Blocker, Methyl- dopa, MAO inhibitors, Tricyclic

### Antidepressant.

- Patients with psychiatric illness.
  - Patients with renal and hepatic dysfunction.
  - Pregnant and Lactating females.
  - Patient taking medications known to interact with pharmacokinetics and pharmacodynamics of study drugs
- Sample size 3 groups of 30 patients each

## Methodology

Preanaesthetic assessment of all the selected patients were done with complete history, general examination, airway assessment, systemic examination along with Blood investigations.

Method of randomization- 90 patients were allocated in three groups of 30 each using computer generated randomization tables.

Group A (n=30)	50 ml normal saline over a period of 10 minutes after induction and before pneumoperitoneum (PNP), followed by a continuous slow infusion at the rate of 0.5 ml/kg/hr.
Group B (n=30)	Clonidine 2µg/kg in 50ml normal saline over a period of 10 minutes after induction and before PNP, followed by a continuous infusion at the rate of 0.5 ml/kg/hr (2 µg/kg/hr).
Group C (n=30)	Dexmedetomidine 1µg/kg in 50ml normal saline over a period of 10 minutes after induction and before PNP, followed by a continuous infusion at the rate of 0.5 ml/kg/hr (0.2 µg/kg/hr).

### Preparation of the patients:

- All the patients were kept nil orally for 6 hours before procedure.
- All patients were uniformly premedicated with inj. Glycopyrrolate 0.2mg IM 30 min before shifting to operation theatre.
- Upon arrival of the patient in the operation theatre, intravenous access with two 18G cannula was established. 500 mL of crystalloid (Ringer's lactate) infusion started from one intravenous cannula.
- All the baseline vital parameters (HR, SBP, DBP, and MAP) were recorded. End tidal Carbon dioxide was monitored intraoperatively and kept between 30-40 mmHg.

### Anesthesia Methods

All the drugs were administered by a person who is not involved in the study to avoid bias. Patients were premedicated with Inj. Fentanyl 2mcg/kg BW followed by preoxygenation with 100% oxygen for 3 minutes by facemask.

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Induction of General anaesthesia was done with inj propofol 2 mg/kg BW. Endotracheal intubation was facilitated with intravenous Vecuronium 0.1 mg/kg BW and ventilation with 100% oxygen for 120 seconds. Intubation condition was assessed. General anaesthesia was maintained with nitrous oxide & oxygen (60:40), loading and intermittent dosage of inj vecuronium according to BW and Isoflurane 0.5-1.0%. The tidal volume and ventilator frequency was adjusted and intermittent positive pressure ventilation (IPPV) was continued by mechanical ventilator to maintain end tidal carbon dioxide between 30-40. After intubation, the infusion of Clonidine (2µg/kg) in 50 mL normal saline or Dexmedetomidine (1 µg/kg) in 50 mL normal saline or 50 mL normalsaline was started 10 min before induction of pneumoperitoneum. This was followed by a continuous infusion clonidine at a rate of 2µg/kg/hr or dexmedetomidine at the rate of 0.2 µg/kg/hr and NS at a rate of 0.5 ml/kg/hr according to the study group. Infusion of drugs is stopped immediate after the release of pneumoperitoneum. During study period haemodynamic parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) were recorded at 0 minute (B), D<sub>0</sub>, D<sub>10</sub>, BPN, APN, APN<sub>10</sub>, APN<sub>20</sub>, APN<sub>30</sub>, APN<sub>40</sub>, APN<sub>50</sub>, APN<sub>90</sub>, RPN, AR, AR<sub>15</sub>, intervals.

PNP - Pneumoperitoneum

- Basal value (0 minute)

D <sub>0</sub>	-	Before study drug/immediate after intubation
D <sub>10</sub>	-	After study drug
BPN	-	Before pneumoperitoneum
APN	-	Just after creation of pneumoperitoneum
APN <sub>10</sub>	-	10 minute after creation of pneumoperitoneum
APN <sub>20</sub>	-	20 minute after creation of pneumoperitoneum
APN <sub>30</sub>	-	30 minute after creation of pneumoperitoneum
APN <sub>40</sub>	-	40 minute after creation of pneumoperitoneum
APN <sub>50</sub>	-	50 minute after creation of pneumoperitoneum
APN <sub>90</sub>	-	90 minute after creation of pneumoperitoneum
RPN	-	5 minutes after Release of pneumoperitoneum
AR	-	After reversal
AR <sub>15</sub>	-	15 minute after reversal

Throughout the procedure for any 20% rise in MAP above the basal MAP, Isoflurane concentration was increased to maintain the basal MAP. For fall in MAP more than 20% of the basal MAP, Isoflurane was decreased or stopped. Heart rate less than 50 bpm was treated with Atropine 0.6 mg intravenously. All the study drugs were stopped once surgical procedure was over and pneumoperitoneum was released.

After surgery, patients were reversed with Inj. Glycopyrrolate 0.005mg/kg and Neostigmine 0.08mg /kg intravenously. After extubation patients were observed for recovery time defined as time to vocalize after extubation.

#### Side Effects And Complications

Patients were closely observed for bradycardia / tachycardia ( $\pm$  20% of basal value), hypotension/hypertension ( $\pm$  20% of basal value), bradyarrhythmia & desaturation (<85%) during intra and postoperative period. During postoperative period along with above, nausea, vomiting, respiratory depression, sedation and shivering were also recorded if occurred. Any complication if occurred was treated with appropriate medications.

#### Statistical Analysis

Statistical analysis was performed by using descriptive and inferential statistics using chi square test/fisher exact test for categorical data. One way ANOVA followed by Post-hoc test is used for comparing mean value between three groups. Paired t-test was used to test the relative change with respect to time. P-value less than 0.05 considered as significant at 95% confidence level. The statistical software SPSS version 16.0 used in the analysis.

#### Ramsay Sedation Score<sup>21</sup>.

Score	Level of sedation
1	Patient is anxious and agitated or restless, or both
2	Patient is co-operative, oriented and tranquil
3	Patient responds to commands only
4	Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5	Patient exhibits a sluggish to light glabellar tap or loud auditory stimulus

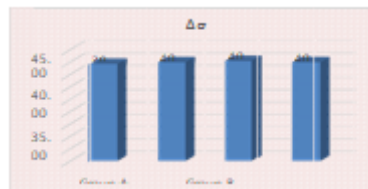
## Results

**TABLE-1**  
**AGE (years) and WEIGHT (kg), DISTRIBUTION IN THREE STUDY GROUPS**

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	F-value	p-value	
				Lower Bound	Upper Bound					
age	Group A	30	39.43	6.97	36.83	42.04	24	49	0.225	0.799
	Group B	30	40.10	7.11	37.44	42.76	27	50		
	Group C	30	40.67	7.28	37.95	43.39	27	50		
	Total	90	40.07	7.06	38.59	41.55	24	50		
wt	Group A	30	56.87	5.53	54.80	58.93	48	69	2.962	0.057
	Group B	30	59.80	7.18	57.12	62.48	48	70		
	Group C	30	56.27	5.15	54.35	58.19	47	68		
	Total	90	57.64	6.15	56.36	58.93	47	70		

Above table is showing age from 20-50 years with mean ( $\pm$ SD) age  $39.43 \pm 6.97$ ,  $40.10 \pm 7.11$  and  $40.67 \pm 7.28$  in groups A, B and C respectively and p-value is not-significant. Above table is showing weight in kg with mean ( $\pm$ SD)  $56.87 \pm 5.53$ ,  $59.80 \pm 7.18$  and  $56.27 \pm 5.15$  in groups A, B and C respectively and p-value is not-significant.

GRAPH -1



Above graph is showing distribution of age among three groups.

GRAPH-2



Above graph is showing distribution of weight in three groups.

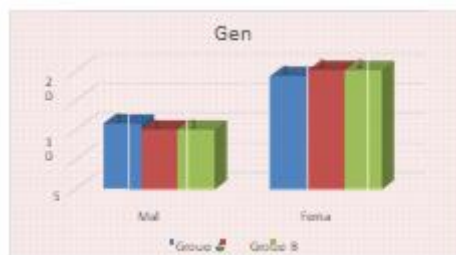
**TABLE-2**  
**SEX (M:F) DISTRIBUTION IN THE STUDY GROUPS**

	Group			Total	Pearson Chi-Square	p-value
	Group A	Group B	Group C			

SEX	Male	11	10	10	31	0.098	0.952
	Female	19	20	20	59		
Total		30	30	30	90		

Above table shows that majority of patients were females in group A, B and C and p-value is not-significant.

GRAPH -3



Above graph is showing distribution of sex in three groups.

**TABLE -3**  
**DURATION (min) OF SURGERY (MEAN ±SD) BETWEEN THREE GROUPS**

DURATION OF SURGERY	GROUP A	GROUP B	GROUP C
MINUTES	73.83±14.74	76.90±13.82	76.83±14.46

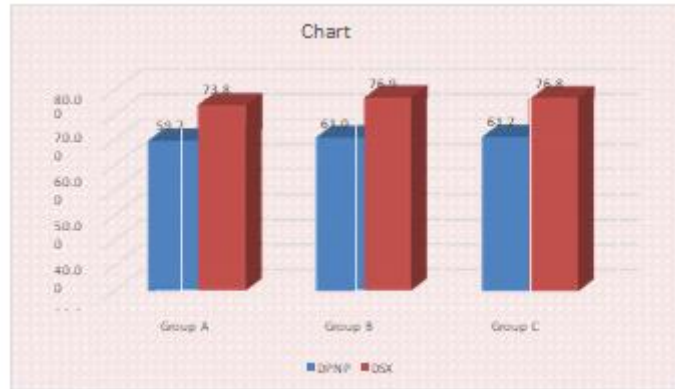
Above table is showing mean duration (min) of surgery (mean ± SD) 73.83±14.74, 76.90±13.82 and 76.83±14.46 minutes in groups A, B and C respectively.

**TABLE- 4**  
**DURATION (min) OF PNEUMOPERITONEUM (MEAN ±SD) BETWEEN THREE GROUPS**

MEAN DURATION OF PNEUMOPERITONEUM	GROUP A	GROUP B	GROUP C
MINUTES	59.73±16.23	61.00±15.28	61.23±15.11

Duration of pneumoperitoneum in group A is 59.73±16.23, group B is 61.00±15.28 and in group C is 61.23±15.11, p value is not-significant.

GRAPH-4



Above graph is showing mean duration of pneumoperitoneum and surgery among three groups.

**TABLE-5**  
**STATISTICAL ANALYSIS OF MEAN ( $\pm$  SD) PULSE RATE (bpm) IN THREE STUDY GROUPS**

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	F-value	p-value	
				Lower Bound	Upper Bound					
HR_B	Group A	30	85.27	5.29	83.29	87.24	76	94	9.89	<0.001
	Group B	30	83.87	3.51	82.56	85.18	78	90		
	Group C	30	80.90	2.22	80.07	81.73	76	88		
	Total	90	83.34	4.25	82.45	84.24	76	94		
HR_D0	Group A	30	101.90	3.67	100.53	103.27	92	110	27.776	<0.001
	Group B	30	98.70	2.68	97.70	99.70	94	106		
	Group C	30	94.60	4.77	92.82	96.38	84	102		
	Total	90	98.40	4.81	97.39	99.41	84	110		
	Group A	30	91.50	3.82	90.07	92.93	84	98	149.408	<0.001
	Group B	30	81.13	4.24	79.55	82.72	75	90		
	Group C	30	75.63	2.55	74.68	76.59	70	80		
	Total	90	82.76	7.52	81.18	84.33	70	98		
	Group A	30	89.77	4.62	88.04	91.49	80	100	97.454	<0.001



Group B	30	81.13	4.34	79.51	82.76	73	90		
Group C	30	75.67	2.54	74.72	76.61	70	80		
Total	90	82.19	7.02	80.72	83.66	70	100		
Group A	30	99.10	4.54	97.40	100.80	88	108	127.982	<0.001
Group B	30	92.07	2.78	91.03	93.10	88	100		
Group C	30	83.83	3.56	82.50	85.16	78	93		
Total	90	91.67	7.26	90.15	93.19	78	108		
Group A	30	89.80	4.65	88.06	91.54	80	98	117.237	<0.001
Group B	30	80.90	3.54	79.58	82.22	75	92		
Group C	30	75.37	2.57	74.41	76.32	70	80		
Total	90	82.02	7.00	80.56	83.49	70	98		
Group A	30	88.83	4.40	87.19	90.47	78	95	96.349	<0.001
Group B	30	81.53	3.76	80.13	82.94	75	90		
Group C	30	75.93	2.38	75.05	76.82	70	80		
Total	90	82.10	6.40	80.76	83.44	70	95		
Group A	30	89.17	4.10	87.63	90.70	78	96	141.514	<0.001
Group B	30	81.97	3.47	80.67	83.26	75	90		
Group C	30	73.87	2.90	72.78	74.95	70	80		
Total	90	81.67	7.19	80.16	83.17	70	96		
Group A	30	90.97	6.01	88.72	93.21	76	99	123.587	<0.001
Group B	30	83.53	3.66	82.17	84.90	75	90		
Group C	30	74.03	1.73	73.39	74.68	70	78		
Total	90	82.84	8.10	81.15	84.54	70	99		
Group	30	94.47	3.67	93.09	95.84	88	102	351.04	<0.001

p A	0							9	1
Group B	30	84.23	2.94	83.13	85.33	78	90		
Group C	30	74.33	1.95	73.60	75.06	72	80		
Total	90	84.34	8.76	82.51	86.18	72	102		
Group A	5	92.60	1.82	90.34	94.86	90	95	87.176	<0.001
Group B	5	86.00	3.08	82.17	89.83	82	90		
Group C	5	74.00	1.58	72.04	75.96	72	76		
Total	15	84.20	8.24	79.64	88.76	72	95		
Group A	30	99.77	4.13	98.22	101.31	92	107	225.618	<0.001
Group B	30	93.77	2.74	92.74	94.79	88	100		
Group C	30	81.87	2.92	80.78	82.96	78	89		
Total	90	91.80	8.17	90.09	93.51	78	107		
Group A	30	103.00	4.81	101.20	104.80	92	110	238.678	<0.001
Group B	30	97.73	2.82	96.68	98.78	92	103		
Group C	30	83.10	3.00	81.98	84.22	77	90		
Total	90	94.61	9.21	92.68	96.54	77	110		
Group A	30	92.00	5.12	90.09	93.91	82	102	134.7	<0.001
Group B	30	88.27	4.72	86.50	90.03	80	100		
Group C	30	74.53	2.84	73.47	75.59	70	80		
Total	90	84.93	8.69	83.11	86.75	70	102		

Above table showing statistical analysis of mean ( $\pm$  SD) pulse rate (bpm) between three groups at different time intervals. The mean ( $\pm$ SD) HR (bpm) before induction was  $85.27 \pm 5.27$  bpm in control group. On comparing with the baseline values there was increase in HR to  $101.90 \pm 3.67$  bpm immediately after intubation which came down to  $91.50 \pm 3.82$  bpm, 10 minutes after intubation, but still it was higher than the baseline value. Immediately after creation of PNP the mean HR significantly increased to  $99.10 \pm 4.54$  bpm which then progressively decreased till 30 minutes after PNP as shown by values APN10 ( $89.80 \pm 4.65$  bpm), APN30 ( $89.17 \pm 4.10$  bpm), but these values were still higher than the baseline values. The mean HR APN50 ( $94.47 \pm 3.67$  bpm) and 90 minutes after PNP to  $92.60 \pm 1.82$  bpm and  $99.77 \pm 4.13$  bpm after release of PNP. It further increased to  $103.0 \pm 4.81$  bpm after reversal. Monitoring of mean HR to 15 minutes after reversal showed decrease in values to  $92.00 \pm 5.12$  bpm.

In clonidine group, the mean ( $\pm$ SD) HR (bpm) before induction was  $83.87 \pm 3.51$  bpm. On comparing with baseline values, increase in HR was observed

immediately after intubation ( $98.70 \pm 2.68$  bpm). Clonidine infusion was started immediately after intubation and mean HR 10 minutes afterward was  $81.13 \pm 4.24$  bpm which was similar to the baseline value. Immediately after creation of PNP, HR increased to  $92.07 \pm 2.78$  bpm which came down towards the APN10 ( $80.90 \pm 3.54$  bpm), APN30 ( $81.97 \pm 3.47$  bpm), and APN90 ( $86.00 \pm 3.08$  bpm).

As compared to baseline value significant increases in HR were observed after the release of PNP ( $93.77 \pm 2.74$  bpm) and after reversal ( $97.73 \pm 2.82$  bpm). The mean HR values slowly returned to baseline values, 15 minutes after reversal ( $88.27 \pm 4.72$  bpm).

The mean ( $\pm$ SD) HR (bpm) before induction was  $80.90 \pm 2.22$  bpm in dexmedetomidine group. On comparing with baseline values increase in mean HR was observed immediately after intubation ( $94.60 \pm 4.77$  bpm). After infusion of loading dose of dexmedetomidine significant fall in mean HR was seen ( $75.63 \pm 2.55$  bpm) which remained similar to baseline values after creation of PNP ( $83.83 \pm 3.56$  bpm). Further observations at regular time intervals after PNP that is APN10 ( $75.37 \pm 2.57$  bpm), APN30 ( $73.87 \pm 2.90$  bpm) and APN50 ( $74.33 \pm 1.95$  bpm) showed decrease in mean HR as compared to baseline values till the release of PNP ( $81.87 \pm 2.92$  bpm). There was a slight increase in mean HR after reversal ( $83.10 \pm 3.00$  bpm) which was similar to baseline value, after which HR decreased to  $74.57 \pm 2.84$  bpm, 15 min after reversal.

GRAPH-5



Above graph is showing variation in HR at various interval among three groups.

**TABLE 6**  
**INTER-GROUP STATISTICAL ANALYSIS OF PULSE RATE (bpm) BETWEEN THREE GROUPS**  
**Multiple Comparisons**

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
HR_B	Group A	Group B	1.4	1.00269	0.347	-0.9909	3.7909
		Group C	4.36667*	1.00269	0	1.9758	6.7576
	Group B	Group A	-1.4	1.00269	0.347	-3.7909	0.9909
		Group C	2.96667*	1.00269	0.011	0.5758	5.3576
	Group C	Group A	-4.36667*	1.00269	0	-6.7576	-1.9758
		Group B	-2.96667*	1.00269	0.011	-5.3576	-0.5758
HR_D0	Group A	Group B	3.20000*	0.98191	0.005	0.8587	5.5413
		Group C	7.30000*	0.98191	0	4.9587	9.6413

	Group B	Group A	-3.20000*	0.98191	0.005	-5.5413	-0.8587
		Group C	4.10000*	0.98191	0	1.7587	6.4413
	Group C	Group A	-7.30000*	0.98191	0	-9.6413	-4.9587
		Group B	-4.10000*	0.98191	0	-6.4413	-1.7587
HR_D10	Group A	Group B	10.36667*	0.93216	0	8.144	12.5894
		Group C	15.86667*	0.93216	0	13.644	18.0894
	Group B	Group A	-10.36667*	0.93216	0	-12.5894	-8.144
		Group C	5.50000*	0.93216	0	3.2773	7.7227
	Group C	Group A	-15.86667*	0.93216	0	-18.0894	-13.644
		Group B	-5.50000*	0.93216	0	-7.7227	-3.2773
HR_BPN	Group A	Group B	8.63333*	1.01841	0	6.2049	11.0617
		Group C	14.10000*	1.01841	0	11.6716	16.5284
	Group B	Group A	-8.63333*	1.01841	0	-11.0617	-6.2049
		Group C	5.46667*	1.01841	0	3.0383	7.8951
	Group C	Group A	-14.10000*	1.01841	0	-16.5284	-11.6716
		Group B	-5.46667*	1.01841	0	-7.8951	-3.0383
HR_APN	Group A	Group B	7.03333*	0.95522	0	4.7556	9.311
		Group C	15.26667*	0.95522	0	12.989	17.5444
	Group B	Group A	-7.03333*	0.95522	0	-9.311	-4.7556
		Group C	8.23333*	0.95522	0	5.9556	10.511
	Group C	Group A	-15.26667*	0.95522	0	-17.5444	-12.989
		Group B	-8.23333*	0.95522	0	-10.511	-5.9556
HR_APN10	Group A	Group B	8.90000*	0.95109	0	6.6321	11.1679
		Group C	14.43333*	0.95109	0	12.1655	16.7012
	Group B	Group A	-8.90000*	0.95109	0	-11.1679	-6.6321
		Group C	5.53333*	0.95109	0	3.2655	7.8012
	Group C	Group A	-14.43333*	0.95109	0	-16.7012	-12.1655
		Group B	-5.53333*	0.95109	0	-7.8012	-3.2655
HR_APN20	Group A	Group B	7.30000*	0.93198	0	5.0777	9.5223
		Group C	12.90000*	0.93198	0	10.6777	15.1223
	Group B	Group A	-7.30000*	0.93198	0	-9.5223	-5.0777
		Group C	5.60000*	0.93198	0	3.3777	7.8223
	Group C	Group A	-12.90000*	0.93198	0	-15.1223	-10.6777
		Group B	-5.60000*	0.93198	0	-7.8223	-3.3777
HR_APN30	Group A	Group B	7.20000*	0.90997	0	5.0302	9.3698
		Group C	15.30000*	0.90997	0	13.1302	17.4698
	Group B	Group A	-7.20000*	0.90997	0	-9.3698	-5.0302
		Group C	8.10000*	0.90997	0	5.9302	10.2698
	Group C	Group A	-15.30000*	0.90997	0	-17.4698	-13.1302
		Group B	-8.10000*	0.90997	0	-10.2698	-5.9302
HR_APN40	Group A	Group B	7.43333*	1.07973	0	4.8587	10.0079
		Group C	16.93333*	1.07973	0	14.3587	19.5079

	Group B	Group A	-7.43333*	1.07973	0	-10.0079	-4.8587
		Group C	9.50000*	1.07973	0	6.9254	12.0746
	Group C	Group A	-16.93333*	1.07973	0	-19.5079	-14.3587
		Group B	-9.50000*	1.07973	0	-12.0746	-6.9254
HR_APN50	Group A	Group B	10.23333*	0.75986	0	8.4215	12.0452
		Group C	20.13333*	0.75986	0	18.3215	21.9452
	Group B	Group A	-10.23333*	0.75986	0	-12.0452	-8.4215
		Group C	9.90000*	0.75986	0	8.0881	11.7119
	Group C	Group A	-20.13333*	0.75986	0	-21.9452	-18.3215
		Group B	-9.90000*	0.75986	0	-11.7119	-8.0881
HR_APN90	Group A	Group B	6.60000*	1.42829	0.002	2.7895	10.4105
		Group C	18.60000*	1.42829	0	14.7895	22.4105
	Group B	Group A	-6.60000*	1.42829	0.002	-10.4105	-2.7895
		Group C	12.00000*	1.42829	0	8.1895	15.8105
	Group C	Group A	-18.60000*	1.42829	0	-22.4105	-14.7895
		Group B	-12.00000*	1.42829	0	-15.8105	-8.1895
HR_RPN	Group A	Group B	6.00000*	0.85778	0	3.9546	8.0454
		Group C	17.90000*	0.85778	0	15.8546	19.9454
	Group B	Group A	-6.00000*	0.85778	0	-8.0454	-3.9546
		Group C	11.90000*	0.85778	0	9.8546	13.9454
	Group C	Group A	-17.90000*	0.85778	0	-19.9454	-15.8546
		Group B	-11.90000*	0.85778	0	-13.9454	-9.8546
HR_AR	Group A	Group B	5.26667*	0.94385	0	3.0161	7.5173
		Group C	19.90000*	0.94385	0	17.6494	22.1506
	Group B	Group A	-5.26667*	0.94385	0	-7.5173	-3.0161
		Group C	14.63333*	0.94385	0	12.3827	16.8839
	Group C	Group A	-19.90000*	0.94385	0	-22.1506	-17.6494
		Group B	-14.63333*	0.94385	0	-16.8839	-12.3827
HR_AR15	Group A	Group B	3.73333*	1.1208	0.004	1.0608	6.4059
		Group C	17.46667*	1.1208	0	14.7941	20.1392
	Group B	Group A	-3.73333*	1.1208	0.004	-6.4059	-1.0608
		Group C	13.73333*	1.1208	0	11.0608	16.4059
	Group C	Group A	-17.46667*	1.1208	0	-20.1392	-14.7941
		Group B	-13.73333*	1.1208	0	-16.4059	-11.0608
*. The mean difference is significant at the 0.05 level.							

### Multiple Comparisons

Above table is showing inter-group statistical analysis of pulse rate (bpm) at different time intervals. There was significant difference in pulse rate in all values except baseline on comparing group A with group B.  $p > 0.05$  – Not significant,  $p \leq 0.05$  – Significant,  $p < 0.01$  – Highly significant.

**TABLE -7**  
**STATISTICAL ANALYSIS OF SYSTOLIC BLOOD PRESSURE MEAN ( $\pm$  SD) (mm Hg) IN THREE STUDY GROUPS**

		N	Mean	Std. Deviation	95% Confidence Interval		Minimum	Maximum	F-value	p-value
					fo	Mean				
SBP_B	Group A	30	125.73	4.92	123.90	127.57	116	132	8.257	0.001
	Group B	30	120.87	5.22	118.92	122.81	110	130		
	Group C	30	124.97	4.82	123.17	126.77	116	132		
	Total	90	123.86	5.38	122.73	124.98	110	132		
SBP_D0	Group A	30	137.07	5.93	134.85	139.28	126	146	5.469	0.006
	Group B	30	134.80	4.74	133.03	136.57	128	143		
	Group C	30	138.83	3.11	137.67	139.99	132	145		
	Total	90	136.90	4.97	135.86	137.94	126	146		
SBP_D10	Group A	30	125.53	4.96	123.68	127.39	116	134	30.511	<0.001
	Group B	30	115.83	5.41	113.81	117.85	108	129		
	Group C	30	118.40	4.55	116.70	120.10	110	128		
	Total	90	119.92	6.43	118.58	121.27	108	134		
SBP_BPN	Group A	30	124.17	3.87	122.72	125.61	117	132	27.522	<0.001
	Group B	30	115.97	5.27	114.00	117.93	108	130		
	Group C	30	118.43	3.89	116.98	119.89	110	126		
	Total	90	119.52	5.55	118.36	120.68	108	132		
SBP_APN	Group A	30	131.97	3.82	130.54	133.39	125	139	38.312	<0.001
	Group B	30	123.57	4.69	121.82	125.32	114	132		
	Group C	30	124.30	3.78	122.89	125.71	118	132		
	Total	90	126.61	5.58	125.44	127.78	114	139		
SBP_APN10	Group A	30	121.80	6.61	119.33	124.27	110	132	5.663	0.005
	Group B	30	118.87	5.40	116.85	120.88	110	129		
	Group C	30	116.87	5.00	115.00	118.73	108	128		
	Total	90	119.1	6.00	117.9	120.4	108	132		

		0	8		2	4				
SBP_APN2 0	Group A	30	118.30	5.30	116.32	120.28	108	128	2.051	0.135
	Group B	30	117.37	6.20	115.05	119.68	109	130		
	Group C	30	115.70	3.11	114.54	116.86	110	124		
	Total	90	117.12	5.10	116.05	118.19	108	130		
	Group A	30	124.30	4.04	122.79	125.81	116	130	24.744	<0.001
	Group B	30	116.63	7.38	113.88	119.39	108	134		
	Group C	30	115.77	3.07	114.62	116.91	110	120		
	Total	90	118.90	6.40	117.56	120.24	108	134		
	Group A	30	124.50	4.44	122.84	126.16	114	134	40.012	<0.001
	Group B	30	116.17	5.12	114.25	118.08	110	126		
	Group C	30	114.90	3.91	113.44	116.36	100	122		
	Total	90	118.52	6.19	117.23	119.82	100	134		
	Group A	30	124.37	3.22	123.16	125.57	116	130	58.194	<0.001
	Group B	30	118.30	5.02	116.43	120.17	110	127		
	Group C	30	112.63	4.21	111.06	114.20	106	120		
	Total	90	118.43	6.37	117.10	119.77	106	130		
	Group A	50	114.40	2.07	111.83	116.97	113	118	1.063	0.376
	Group B	50	114.40	3.78	109.70	119.10	110	120		
	Group C	50	112.00	2.92	108.38	115.62	110	117		

Total	15	113.60	3.02	111.93	115.27	110	120		
Group A	30	130.70	6.08	128.43	132.97	120	140	32.782	<0.001
Group B	30	122.57	6.09	120.29	124.84	113	134		
Group C	30	119.83	3.70	118.45	121.21	110	126		
Total	90	124.37	7.08	122.88	125.85	110	140		
Group A	30	135.23	6.96	132.64	137.83	122	146	18.69	<0.001
Group B	30	127.13	6.66	124.65	129.62	113	136		
Group C	30	125.83	5.67	123.72	127.95	116	137		
Total	90	129.40	7.63	127.80	131.00	113	146		
Group A	30	123.90	5.38	121.89	125.91	114	133	12.279	<0.001
Group B	30	119.60	6.77	117.07	122.13	109	132		
Group C	30	117.10	3.46	115.81	118.39	110	123		
Total	90	120.20	6.02	118.94	121.46	109	133		

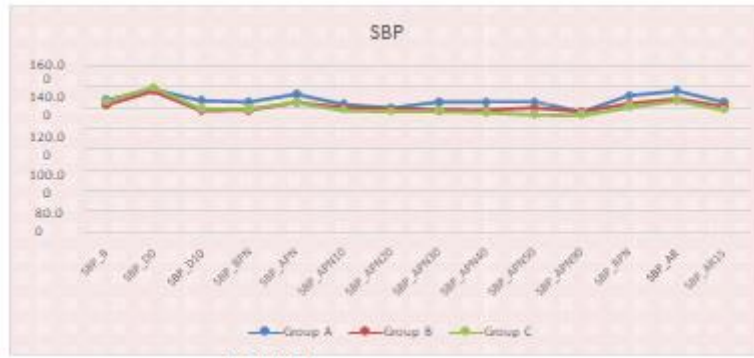
According to above Table, the mean ( $\pm$ SD) SBP (mmHg) before induction was  $125.73 \pm 4.92$  mmHg in control group. On comparing with baseline values, increase in SBP were observed immediately after intubation ( $137.07 \pm 5.93$  mmHg), APN ( $131.97 \pm 3.82$  mmHg) and after RPN ( $130.70 \pm$  mmHg). During whole PNP, no significant changes in SBP were observed as shown by values APN10 ( $125.53 \pm 4.96$  mmHg), APN30 ( $124.30 \pm 4.04$  mmHg), and APN50 ( $124.37 \pm 3.22$  mmHg) ( $p > 0.05$ ). There was increase in SBP found after the reversal ( $135.23 \pm 6.96$  mmHg) which decreased to  $123.90 \pm 5.38$  mmHg, 15 minutes after reversal.

In clonidine group, the mean ( $\pm$ SD) SBP (mmHg) before induction was  $120.87 \pm 5.22$  mmHg. On comparing with baseline values significant increase in SBP were observed immediately after intubation ( $134.80 \pm 4.74$  mmHg) and APN ( $123.57 \pm 4.69$  mmHg). Significant fall in SBP was found after infusion of loading dose of clonidine D10 ( $118.87 \pm 5.40$  mmHg) and decrease in SBP were also seen throughout the PNP as shown by values APN20 ( $117.37 \pm 6.20$  mmHg), APN30 ( $116.63 \pm 7.38$  mmHg), and APN90 ( $114.40 \pm 3.78$  mmHg). After the release of PNP, SBP increased to  $122.57 \pm 6.09$  mmHg followed by another rise in SBP after the reversal ( $127.13 \pm 6.66$ ) which decreased to  $119.60 \pm 6.77$  mmHg, 15 minutes after reversal.

In dexmedetomidine group, the mean ( $\pm$ SD) SBP (mmHg) before induction was  $124.97 \pm 4.827$  mmHg. On comparing with baseline values, increase in SBP was observed immediately after intubation to  $138.83 \pm 3.11$  mmHg. A significant fall in SBP was found after infusion of loading dose of dexmedetomidine ( $118.40 \pm 4.55$



mmHg) which remained lower even after creation of PNP(124.30±3.78mmHg) . During the whole PNP, fall in SBP was observed as shown by values APN10 (116.87±5.00 mmHg), APN30 (115.77±3.05 mmHg) and APN50 (112.63±4.21 mmHg) . After the release of PNP, SBP increased to 119.83±3.70 mmHg but still remained lower than the preinduction values, followed by an insignificant rise in SBP after the reversal (125.83±3.67 mmHg) which decreased to 117.10±3.46 mmHg, 15 minutes after reversal .



GRAPH-6  
Above graph is showing variation in SBP at various interval among three groups.

**TABLE- 8**  
**INTER GROUP STATISTICAL ANALYSIS OF SYSTOLIC BLOOD PRESSURE(mmHg) AMONG THREE GROUPS**

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
SBP_B	Group A	Group B	4.86667*	1.28781	0.001	1.7959	7.9374
		Group C	0.76667	1.28781	0.823	-2.3041	3.8374
	Group B	Group A	-4.86667*	1.28781	0.001	-7.9374	-1.7959
		Group C	-4.10000*	1.28781	0.006	-7.1708	-1.0292
	Group C	Group A	-0.76667	1.28781	0.823	-3.8374	2.3041
		Group B	4.10000*	1.28781	0.006	1.0292	7.1708
SBP_D0	Group A	Group B	2.26667	1.22266	0.158	-0.6487	5.1821
		Group C	-1.76667	1.22266	0.323	-4.6821	1.1487
	Group B	Group A	-2.26667	1.22266	0.158	-5.1821	0.6487
		Group C	-4.03333*	1.22266	0.004	-6.9487	-1.1179
	Group C	Group A	1.76667	1.22266	0.323	-1.1487	4.6821
		Group B	4.03333*	1.22266	0.004	1.1179	6.9487
SBP_D10	Group A	Group B	9.70000*	1.28678	0	6.6317	12.7683
		Group C	7.13333*	1.28678	0	4.065	10.2016
	Group B	Group A	-9.70000*	1.28678	0	-12.7683	-6.6317
		Group C	-2.56667	1.28678	0.12	-5.635	0.5016
	Group C	Group A	-7.13333*	1.28678	0	-10.2016	-4.065
		Group B	2.56667	1.28678	0.12	-0.5016	5.635
SBP_BPN	Group A	Group B	8.20000*	1.13411	0	5.4957	10.9043
		Group C	5.73333*	1.13411	0	3.0291	8.4376

	Group B	Group A	-8.20000*	1.13411	0	-10.9043	-5.4957
		Group C	-2.46667	1.13411	0.081	-5.1709	0.2376
	Group C	Group A	-5.73333*	1.13411	0	-8.4376	-3.0291
		Group B	2.46667	1.13411	0.081	-0.2376	5.1709
SBP_APN	Group A	Group B	8.40000*	1.06301	0	5.8653	10.9347
		Group C	7.66667*	1.06301	0	5.1319	10.2014
	Group B	Group A	-8.40000*	1.06301	0	-10.9347	-5.8653
		Group C	-0.73333	1.06301	0.77	-3.2681	1.8014
	Group C	Group A	-7.66667*	1.06301	0	-10.2014	-5.1319
		Group B	0.73333	1.06301	0.77	-1.8014	3.2681
SBP_APN10	Group A	Group B	2.93333	1.47462	0.121	-0.5829	6.4495
		Group C	4.93333*	1.47462	0.003	1.4171	8.4495
	Group B	Group A	-2.93333	1.47462	0.121	-6.4495	0.5829
		Group C	2	1.47462	0.368	-1.5162	5.5162
	Group C	Group A	-4.93333*	1.47462	0.003	-8.4495	-1.4171
		Group B	-2	1.47462	0.368	-5.5162	1.5162
SBP_APN20	Group A	Group B	0.93333	1.30062	0.754	-2.168	4.0346
		Group C	2.6	1.30062	0.119	-0.5013	5.7013
	Group B	Group A	-0.93333	1.30062	0.754	-4.0346	2.168
		Group C	1.66667	1.30062	0.409	-1.4346	4.768
	Group C	Group A	-2.6	1.30062	0.119	-5.7013	0.5013
		Group B	-1.66667	1.30062	0.409	-4.768	1.4346
SBP_APN30	Group A	Group B	7.66667*	1.33524	0	4.4828	10.8505
		Group C	8.53333*	1.33524	0	5.3495	11.7172
	Group B	Group A	-7.66667*	1.33524	0	-10.8505	-4.4828
		Group C	0.86667	1.33524	0.793	-2.3172	4.0505
	Group C	Group A	-8.53333*	1.33524	0	-11.7172	-5.3495
		Group B	-0.86667	1.33524	0.793	-4.0505	2.3172
SBP_APN40	Group A	Group B	8.33333*	1.16605	0	5.5529	11.1138
		Group C	9.60000*	1.16605	0	6.8196	12.3804
	Group B	Group A	-8.33333*	1.16605	0	-11.1138	-5.5529
		Group C	1.26667	1.16605	0.525	-1.5138	4.0471
	Group C	Group A	-9.60000*	1.16605	0	-12.3804	-6.8196
		Group B	-1.26667	1.16605	0.525	-4.0471	1.5138
SBP_APN50	Group A	Group B	6.06667*	1.08781	0	3.4728	8.6605
		Group C	11.73333*	1.08781	0	9.1395	14.3272
	Group B	Group A	-6.06667*	1.08781	0	-8.6605	-3.4728
		Group C	5.66667*	1.08781	0	3.0728	8.2605
	Group C	Group A	-11.73333*	1.08781	0	-14.3272	-9.1395
		Group B	-5.66667*	1.08781	0	-8.2605	-3.0728
SBP_APN90	Group A	Group B	0	1.90088	1	-5.0713	5.0713
		Group C	2.4	1.90088	0.441	-2.6713	7.4713

	Group B	Group A	0	1.90088	1	-5.0713	5.0713
		Group C	2.4	1.90088	0.441	-2.6713	7.4713
	Group C	Group A	-2.4	1.90088	0.441	-7.4713	2.6713
		Group B	-2.4	1.90088	0.441	-7.4713	2.6713
SBP_RPN	Group A	Group B	8.13333*	1.39617	0	4.8042	11.4625
		Group C	10.86667*	1.39617	0	7.5375	14.1958
	Group B	Group A	-8.13333*	1.39617	0	-11.4625	-4.8042
		Group C	2.73333	1.39617	0.129	-0.5958	6.0625
	Group C	Group A	-10.86667*	1.39617	0	-14.1958	-7.5375
		Group B	-2.73333	1.39617	0.129	-6.0625	0.5958
SBP_AR	Group A	Group B	8.10000*	1.66621	0	4.127	12.073
		Group C	9.40000*	1.66621	0	5.427	13.373
	Group B	Group A	-8.10000*	1.66621	0	-12.073	-4.127
		Group C	1.3	1.66621	0.716	-2.673	5.273
	Group C	Group A	-9.40000*	1.66621	0	-13.373	-5.427
		Group B	-1.3	1.66621	0.716	-5.273	2.673
SBP_AR15	Group A	Group B	4.30000*	1.38813	0.007	0.99	7.61
		Group C	6.80000*	1.38813	0	3.49	10.11
	Group B	Group A	-4.30000*	1.38813	0.007	-7.61	-0.99
		Group C	2.5	1.38813	0.175	-0.81	5.81
	Group C	Group A	-6.80000*	1.38813	0	-10.11	-3.49
		Group B	-2.5	1.38813	0.175	-5.81	0.81
*. The mean difference is significant at the 0.05 level.							

Above table is showing inter-group statistical analysis of systolic blood pressure (mmHg) at different time intervals. There was significant ( $p < 0.05$ ) difference in systolic blood pressure seen after infusion of study drug (D10), before pneumoperitoneum (BPN), after pneumoperitoneum (APN), 30 and 40 minute after pneumoperitoneum, after release of pneumoperitoneum (RPN) and after reversal (AR) on comparing group A with group B. While on comparing groups A and C, significant changes in systolic blood pressure were present after infusion of study drug (D10), before pneumoperitoneum (BPN), after pneumoperitoneum (APN), 10, 30, 40, 50 minutes after pneumoperitoneum, after release of pneumoperitoneum (RPN) and after reversal (AR). On comparing group B with C, significant changes in systolic blood pressure were present only at 50 and 60 minutes after pneumoperitoneum.

**TABLE-9**  
**STATISTICAL ANALYSIS OF MEAN ( $\pm$  SD) DIASTOLIC BLOOD PRESSURE (mmHg) IN THREE STUDY GROUPS**

	N	Mean	Std. Deviation	95% Confidence Interval		Minimum	Maximum	F-value	P-value	
				Lower Bound	Upper Bound					
DBP_B	Group A	30	81.57	1.65	80.95	82.18	78	84	8.104	0.001

	Group B	30	78.30	3.79	76.89	79.71	73	88		
	Group C	30	80.00	3.54	78.68	81.32	72	90		
	Total	90	79.96	3.39	79.25	80.66	72	90		
DBP_D0	Group A	30	92.17	6.75	89.65	94.69	74	100	0.155	0.857
	Group B	30	92.73	3.80	91.32	94.15	83	100		
	Group C	30	92.83	3.89	91.38	94.28	84	100		
	Total	90	92.58	4.95	91.54	93.62	74	100		
DBP_D10	Group A	30	83.00	3.18	81.81	84.19	78	93	40.73	<0.001
	Group B	30	75.77	5.54	73.70	77.84	67	85		
	Group C	30	74.23	2.75	73.21	75.26	70	80		
	Total	90	77.67	5.53	76.51	78.82	67	93		
	Group A	30	82.83	2.15	82.03	83.64	79	89	52.209	<0.001
	Group B	30	75.30	4.72	73.54	77.06	68	83		
	Group C	30	74.03	3.48	72.73	75.33	69	82		
	Total	90	77.39	5.29	76.28	78.50	68	89		
	Group A	30	87.33	5.73	85.20	89.47	77	97	17.634	<0.001
	Group B	30	80.23	5.58	78.15	82.32	70	93		
	Group C	30	80.70	4.08	79.18	82.22	72	90		
	Total	90	82.76	6.07	81.48	84.03	70	97		
	Group A	30	79.30	2.07	78.53	80.07	75	83	17.02	<0.001
	Group B	30	76.07	5.60	73.98	78.16	67	85		
	Group C	30	73.47	3.08	72.32	74.62	69	80		
	Total	90	76.28	4.52	75.33	77.23	67	85		
	Group A	30	78.63	3.46	77.34	79.92	70	86	19.012	<0.001
	Group B	30	75.43	2.65	74.44	76.42	71	80		
	Group C	30	73.40	3.74	72.00	74.80	67	82		

Total	90	75.82	3.93	75.00	76.64	67	86		
Group A	30	82.07	1.41	81.54	82.59	80	85	139.527	<0.001
Group B	30	75.17	2.55	74.22	76.12	70	82		
Group C	30	73.33	2.28	72.48	74.18	70	78		
Total	90	76.86	4.33	75.95	77.76	70	85		
Group A	30	84.13	5.32	82.15	86.12	75	93	64.863	<0.001
Group B	30	75.00	3.92	73.54	76.46	68	85		
Group C	30	72.50	2.90	71.42	73.58	67	79		
Total	90	77.21	6.50	75.85	78.57	67	93		
Group A	30	83.47	3.93	82.00	84.93	75	92	53.843	<0.001
Group B	30	76.33	4.63	74.61	78.06	68	88		
Group C	30	73.40	2.82	72.35	74.45	68	80		
Total	90	77.73	5.72	76.54	78.93	68	92		
Group A	50	78.20	1.30	76.58	79.82	76	79	16.358	<0.001
Group B	50	73.60	2.30	70.74	76.46	70	76		
Group C	50	72.00	1.58	70.04	73.96	70	74		
Total	150	74.60	3.18	72.84	76.36	70	79		
Group A	30	88.00	4.11	86.47	89.53	79	96	21.331	<0.001
Group B	30	81.23	6.61	78.77	83.70	67	91		
Group C	30	81.03	2.41	80.13	81.93	77	86		
Total	90	83.42	5.68	82.23	84.61	67	96		
Group A	30	92.00	2.32	91.13	92.87	88	97	38.19	<0.001
Group B	30	87.73	4.42	86.08	89.38	80	94		
Group C	30	84.47	2.96	83.36	85.57	78	90		

Total	90	88.07	4.54	87.12	89.02	78	97		
Group A	30	84.50	4.42	82.85	86.15	77	93	11.743	<0.001
Group B	30	79.80	4.89	77.97	81.63	69	88		
Group C	30	77.70	7.04	75.07	80.33	70	108		
Total	90	80.67	6.20	79.37	81.97	69	108		

As shown in table no.9,the mean ( $\pm$ SD) DBP (mmHg) before induction was  $81.57\pm 1.65$  mmHg in control group .On comparing with baseline values,increase in DBP were observed immediately after intubation ( $92.17\pm 6.75$  mmHg), APN (87.33 $\pm$ 5.73 mmHg) and after RPN ( $88.00\pm 4.11$ mmHg). During whole PNP, no significant changes in DBP were observed as shown by values APN10 ( $79.03\pm 2.07$  mmHg), APN30 ( $83.07\pm 1.41$  mmHg), and APN50( $83.47\pm 3.93$  mmHg) .There was increase in DBP found after the reversal ( $92.00\pm 2.32$  mmHg) which decreased to  $84.50\pm 4.42$  mmHg,15 minutes after reversal .

In clonidine group,the mean ( $\pm$ SD) DBP (mmHg) before induction was  $78.30\pm 3.79$  mmHg.On comparing with baseline values,increase in SBP were observed immediately after intubation ( $92.73\pm 3.80$  mmHg), APN ( $80.23\pm 5.58$  mmHg) and after RPN ( $81.23\pm 6.61$  mmHg).Decrease in DBP found after infusion of loading dose of clonidine D10 ( $76.07\pm 5.08$  mmHg) which remained lower throughout the PNP as shown by values APN10 ( $76.07\pm 5.08$  mmHg), APN30 ( $75.17\pm 2.55$  mmHg), and APN90 ( $73.60\pm 2.30$  mmHg) .There was increase in DBP after the reversal ( $87.73\pm 4.42$  mmHg) which decreased to  $79.80\pm 4.89$  mmHg,15 minutes after reversal .

The mean ( $\pm$ SD) DBP (mmHg) before induction was  $80.00\pm 3.54$ mmHg in dexmedetomidine group.On comparing with baseline values, increase in DBP was observed immediately after intubation to  $92.83\pm 3.89$ mmHg . Decrease in DBP was found after infusion of loading dose of dexmedetomidine ( $74.23\pm 2.55$  mmHg) which increased to  $80.70\pm 4.08$  mmHg immediately after creation of PNP .During the whole PNP ,fall in DBP were observed as shown by values APN10 ( $73.47\pm 3.08$  mmHg), APN30 ( $73.33\pm 2.28$  mmHg) and APN50( $73.40\pm 2.82$  mmHg) .After the release of PNP,DBP increased to  $81.03\pm 2.41$  mmHg followed by rise in DBP after the reversal ( $84.47\pm 2.96$  mmHg) which decreased to  $77.70\pm 7.04$ mmHg,15 min after reversal .

**TABLE- 10**  
**INTER GROUP STATISTICAL ANALYSIS OF DIASTOLIC BLOOD PRESSURE (mmHg) AMONG THREE GROUPS**

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
DBP_B	Group A	Group B	3.26667*	0.81163	0	1.3313	5.202
		Group C	1.56667	0.81163	0.136	-0.3687	3.502
	Group B	Group A	-3.26667*	0.81163	0	-5.202	-1.3313
		Group C	-1.7	0.81163	0.097	-3.6353	0.2353
	Group C	Group A	-1.56667	0.81163	0.136	-3.502	0.3687
		Group B	1.7	0.81163	0.097	-0.2353	3.6353
DBP_D0	Group A	Group B	-0.56667	1.29135	0.899	-3.6459	2.5125
		Group C	-0.66667	1.29135	0.864	-3.7459	2.4125
	Group B	Group A	0.56667	1.29135	0.899	-2.5125	3.6459

		Group C	-0.1	1.29135	0.997	-3.1792	2.9792
	Group C	Group A	0.66667	1.29135	0.864	-2.4125	3.7459
		Group B	0.1	1.29135	0.997	-2.9792	3.1792
DBP_D10	Group A	Group B	7.23333*	1.03751	0	4.7594	9.7073
		Group C	8.76667*	1.03751	0	6.2927	11.2406
	Group B	Group A	-7.23333*	1.03751	0	-9.7073	-4.7594
		Group C	1.53333	1.03751	0.306	-0.9406	4.0073
	Group C	Group A	-8.76667*	1.03751	0	-11.2406	-6.2927
		Group B	-1.53333	1.03751	0.306	-4.0073	0.9406
DBP_BPN	Group A	Group B	7.53333*	0.93113	0	5.3131	9.7536
		Group C	8.80000*	0.93113	0	6.5797	11.0203
	Group B	Group A	-7.53333*	0.93113	0	-9.7536	-5.3131
		Group C	1.26667	0.93113	0.366	-0.9536	3.4869
	Group C	Group A	-8.80000*	0.93113	0	-11.0203	-6.5797
		Group B	-1.26667	0.93113	0.366	-3.4869	0.9536
DBP_APN	Group A	Group B	7.10000*	1.33745	0	3.9109	10.2891
		Group C	6.63333*	1.33745	0	3.4442	9.8224
	Group B	Group A	-7.10000*	1.33745	0	-10.2891	-3.9109
		Group C	-0.46667	1.33745	0.935	-3.6558	2.7224
	Group C	Group A	-6.63333*	1.33745	0	-9.8224	-3.4442
		Group B	0.46667	1.33745	0.935	-2.7224	3.6558
DBP_APN10	Group A	Group B	3.23333*	1.00177	0.005	0.8446	5.622
		Group C	5.83333*	1.00177	0	3.4446	8.222
	Group B	Group A	-3.23333*	1.00177	0.005	-5.622	-0.8446
		Group C	2.60000*	1.00177	0.03	0.2113	4.9887
	Group C	Group A	-5.83333*	1.00177	0	-8.222	-3.4446
		Group B	-2.60000*	1.00177	0.03	-4.9887	-0.2113
DBP_APN20	Group A	Group B	3.20000*	0.85569	0.001	1.1596	5.2404
		Group C	5.23333*	0.85569	0	3.193	7.2737
	Group B	Group A	-3.20000*	0.85569	0.001	-5.2404	-1.1596
		Group C	2.03333	0.85569	0.051	-0.007	4.0737
	Group C	Group A	-5.23333*	0.85569	0	-7.2737	-3.193
		Group B	-2.03333	0.85569	0.051	-4.0737	0.007
DBP_APN30	Group A	Group B	6.90000*	0.55135	0	5.5853	8.2147
		Group C	8.73333*	0.55135	0	7.4187	10.048
	Group B	Group A	-6.90000*	0.55135	0	-8.2147	-5.5853
		Group C	1.83333*	0.55135	0.004	0.5187	3.148
	Group C	Group A	-8.73333*	0.55135	0	-10.048	-7.4187
		Group B	-1.83333*	0.55135	0.004	-3.148	-0.5187
DBP_APN40	Group A	Group B	9.13333*	1.07531	0	6.5693	11.6974
		Group C	11.63333*	1.07531	0	9.0693	14.1974
	Group B	Group A	-9.13333*	1.07531	0	-11.6974	-6.5693

		Group C	2.5	1.07531	0.058	-0.0641	5.0641
	Group C	Group A	-11.63333*	1.07531	0	-14.1974	-9.0693
		Group B	-2.5	1.07531	0.058	-5.0641	0.0641
DBP_APN50	Group A	Group B	7.13333*	0.99783	0	4.754	9.5126
		Group C	10.06667*	0.99783	0	7.6874	12.446
	Group B	Group A	-7.13333*	0.99783	0	-9.5126	-4.754
		Group C	2.93333*	0.99783	0.012	0.554	5.3126
	Group C	Group A	-10.06667*	0.99783	0	-12.446	-7.6874
		Group B	-2.93333*	0.99783	0.012	-5.3126	-0.554
DBP_APN90	Group A	Group B	4.60000*	1.12546	0.004	1.5974	7.6026
		Group C	6.20000*	1.12546	0	3.1974	9.2026
	Group B	Group A	-4.60000*	1.12546	0.004	-7.6026	-1.5974
		Group C	1.6	1.12546	0.361	-1.4026	4.6026
	Group C	Group A	-6.20000*	1.12546	0	-9.2026	-3.1974
		Group B	-1.6	1.12546	0.361	-4.6026	1.4026
DBP_RPN	Group A	Group B	6.76667*	1.21432	0	3.8711	9.6622
		Group C	6.96667*	1.21432	0	4.0711	9.8622
	Group B	Group A	-6.76667*	1.21432	0	-9.6622	-3.8711
		Group C	0.2	1.21432	0.985	-2.6955	3.0955
	Group C	Group A	-6.96667*	1.21432	0	-9.8622	-4.0711
		Group B	-0.2	1.21432	0.985	-3.0955	2.6955
DBP_AR	Group A	Group B	4.26667*	0.86451	0	2.2053	6.3281
		Group C	7.53333*	0.86451	0	5.4719	9.5947
	Group B	Group A	-4.26667*	0.86451	0	-6.3281	-2.2053
		Group C	3.26667*	0.86451	0.001	1.2053	5.3281
	Group C	Group A	-7.53333*	0.86451	0	-9.5947	-5.4719
		Group B	-3.26667*	0.86451	0.001	-5.3281	-1.2053
DBP_AR15	Group A	Group B	4.70000*	1.43695	0.004	1.2736	8.1264
		Group C	6.80000*	1.43695	0	3.3736	10.2264
	Group B	Group A	-4.70000*	1.43695	0.004	-8.1264	-1.2736
		Group C	2.1	1.43695	0.314	-1.3264	5.5264
	Group C	Group A	-6.80000*	1.43695	0	-10.2264	-3.3736
		Group B	-2.1	1.43695	0.314	-5.5264	1.3264
*. The mean difference is significant at the 0.05 level.							

Above table is showing inter-group statistical analysis of diastolic blood pressure (mmHg) at different time intervals. There was significant ( $p < 0.05$ ) difference in diastolic blood pressure seen after study drug administration (D10), before pneumoperitoneum (BPM), after pneumoperitoneum (APN), 10, 20, 30, 40 and 50 minutes after pneumoperitoneum, after release of pneumoperitoneum (RPN), after reversal (AR) and 15 minutes after reversal (AR) on comparing group A with group B. While on comparing groups A and C, significant changes in diastolic blood pressure were present in all values except baseline values (B), after intubation (D0). On comparing group B with C no significant ( $p > 0.05$ ) changes in diastolic blood pressure were present in any value except (APN30) and after reversal (AR).

#### GRAPH-7





Above graph is showing variation in DBP at various intervals among three groups.

**TABLE-11**  
**STATISTICAL ANALYSIS OF MEAN ( $\pm$  SD) MEAN ARTERIAL PRESSURE (mmHg) IN THREE STUDY GROUPS**

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	F-value	p-value	
				Lower Bound	Upper Bound					
MAP_B	Group A	30	96.27	2.16	95.46	97.07	92	99	14.823	<0.001
	Group B	29	92.31	3.41	91.01	93.61	87	100		
	Group C	30	95.00	2.84	93.94	96.06	89	103		
	Total	89	94.55	3.26	93.86	95.24	87	103		
MAP_D0	Group A	30	106.97	4.40	105.32	108.61	98	115	1.514	0.226
	Group B	30	106.80	3.22	105.60	108.00	98	113		
	Group C	30	108.23	2.61	107.26	109.21	103	113		
	Total	90	107.33	3.51	106.60	108.07	98	115		
MAP_D10	Group A	30	97.27	2.42	96.36	98.17	92	102	59.59	<0.001
	Group B	30	89.07	4.76	87.29	90.85	81	97		
	Group C	30	89.00	2.36	88.12	89.88	85	95		
	Total	90	91.78	5.13	90.70	92.85	81	102		

MAP_BPN	Group A	30	96.67	1.86	95.97	97.36	92	99	70.661	<0.001
	Group B	30	88.87	4.07	87.35	90.39	82	95		
	Group C	30	88.83	2.44	87.92	89.74	85	95		
	Total	90	91.46	4.71	90.47	92.44	82	99		
MAP_APN	Group A	30	102.20	3.79	100.78	103.62	96	108	38.849	<0.001
	Group B	30	94.70	3.81	93.28	96.12	86	102		
	Group C	30	95.23	3.42	93.96	96.51	88	100		
	Total	90	97.38	5.00	96.33	98.43	86	108		
MAP_APN10	Group A	30	93.50	2.67	92.50	94.50	88	98	20.228	<0.001
	Group B	30	90.40	4.55	88.70	92.10	83	99		
	Group C	30	87.83	2.83	86.78	88.89	83	94		
	Total	90	90.58	4.14	89.71	91.44	83	99		
MAP_APN20	Group A	30	91.80	3.27	90.58	93.02	85	97	14.675	<0.001
	Group B	30	89.47	2.94	88.37	90.57	84	95		
	Group C	30	87.57	2.86	86.50	88.64	81	92		
	Total	90	89.61	3.47	88.89	90.34	81	97		
MAP_APN30	Group A	30	96.17	1.58	95.58	96.76	93	99	120.783	<0.001
	Group B	30	88.97	3.23	87.76	90.17	83	96		
	Group C	30	87.40	1.83	86.72	88.08	83	91		

	Total	90	90.84	4.48	89.91	91.78	83	99		
MAP_APN40	Group A	30	97.67	3.78	96.25	99.08	89	104	65.219	<0.001
	Group B	30	88.77	2.91	87.68	89.85	83	95		
	Group C	30	87.37	4.51	85.68	89.05	80	108		
	Total	90	91.27	5.92	90.03	92.51	80	108		
MAP_APN50	Group A	30	97.13	2.90	96.05	98.22	91	104	118.804	<0.001
	Group B	30	90.37	3.21	89.17	91.57	84	98		
	Group C	30	86.17	2.12	85.38	86.96	83	91		
	Total	90	91.22	5.31	90.11	92.33	83	104		
MAP_APN90	Group A	5	90.40	0.55	89.72	91.08	90	91	12.585	0.001
	Group B	5	87.20	2.28	84.37	90.03	85	91		
	Group C	5	85.20	1.64	83.16	87.24	83	87		
	Total	15	87.60	2.69	86.11	89.09	83	91		
MAP_RPN	Group A	30	102.23	3.52	100.92	103.55	94	107	47.384	<0.001
	Group B	30	95.03	3.66	93.67	96.40	88	101		
	Group C	30	94.30	3.27	93.08	95.52	90	106		
	Total	90	97.19	4.99	96.14	98.23	88	107		
MAP_AR	Group A	30	106.43	2.94	105.33	107.53	101	111	50.499	<0.001
	Group B	30	100.83	3.59	99.49	102.17	94	107		

	Group C	30	98.27	3.08	97.12	99.42	93	106		
	Total	90	101.84	4.68	100.86	102.82	93	111		
MAP_AR15	Group A	30	97.67	3.52	96.35	98.98	92	104	21.008	<0.001
	Group B	30	93.00	3.79	91.59	94.41	84	99		
	Group C	30	90.80	5.09	88.90	92.70	84	111		
	Total	90	93.82	5.04	92.77	94.88	84	111		

According to table no.11, the mean ( $\pm$ SD) MAP (mmHg) before induction was  $96.27 \pm 2.16$  mmHg in control group .On comparing with baseline values, increase in MAP were observed immediately after intubation ( $106.97 \pm 4.40$  mmHg), APN ( $102.20 \pm 3.79$  mmHg) and after RPN ( $102.23 \pm 3.52$ mmHg).During whole PNP, insignificant changes in MAP were observed as shown by values APN10 ( $93.50 \pm 2.67$ ), APN30 ( $96.17 \pm 1.58$  mmHg), and APN50 ( $97.13 \pm 2.90$  mmHg) .There was increase in MAP found after the reversal ( $106.43 \pm 2.94$  mmHg) which decreased to  $97.67 \pm 3.52$  mmHg, 15 minutes after reversal .

In clonidine group,the mean ( $\pm$ SD) MAP (mmHg) before induction was  $92.31 \pm 3.41$  mmHg. On comparing with baseline values ,increase in SBP were observed immediately after intubation ( $106.80 \pm 3.22$  mmHg) and APN ( $94.70 \pm 3.81$  mmHg). Decrease in MAP was found after infusion of loading dose of clonidine ( $89.07 \pm 4.06$  mmHg) which remained lower throughout the PNP as shown by values APN10 ( $89.07 \pm 4.06$  mmHg) , APN20 ( $89.47 \pm 2.94$  mmHg), APN30 ( $88.97 \pm 3.23$  mmHg), and APN90 ( $87.20 \pm 2.28$  mmHg) . After the release of PNP, MAP increased to  $95.03 \pm 3.06$ mmHg and remained significantly elevated after the reversal ( $100.83 \pm 3.59$  mmHg) which gradually decreased to  $93.00 \pm 3.79$  mmHg 15 minutes after reversal .

As shown in the above mentioned table 11,the mean ( $\pm$ SD) MAP (mmHg) before induction was  $95.00 \pm 2.84$ vmmHg in dexmedetomidine group.On comparing with baseline values increase in MAP was observed immediately after intubation to  $108.23 \pm 2.61$  mmHg. Decrease in MAP found after infusion of loading dose of dexmedetomidine ( $89.00 \pm 2.36$  mmHg) which increased to  $95.23 \pm 3.42$  mmHg immediately after creation of PNP.During the whole PNP,fall in MAP were observed as shown by values APN10 ( $87.83 \pm 2.83$ mmHg), APN30 ( $87.40 \pm 1.83$ mmHg) and APN50 ( $86.17 \pm 2.12$  mmHg) .After the release of PNP, MAP increased to  $94.30 \pm 3.27$  mmHg but still remained higher after the reversal ( $98.27 \pm 3.08$  mmHg) which decreased to  $90.80 \pm 5.09$  mmHg,15 min after reversal

**TABLE -12**  
**INTER GROUP STATISTICAL ANALYSIS OF MEAN ARTERIAL BLOOD PRESSURE (mmHg) AMONG THREE GROUPS**

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
MAP_B	Group A	Group B	3.95632*	0.74087	0	2.1894	5.7233
		Group C	1.26667	0.73457	0.202	-0.4853	3.0186
	Group	Group A	-3.95632*	0.74087	0	-5.7233	-2.1894

	B	Group C	-2.68966*	0.74087	0.001	-4.4566	-0.9227
	Group C	Group A	-1.26667	0.73457	0.202	-3.0186	0.4853
		Group B	2.68966*	0.74087	0.001	0.9227	4.4566
MAP_D0	Group A	Group B	0.16667	0.90089	0.981	-1.9815	2.3148
		Group C	-1.26667	0.90089	0.342	-3.4148	0.8815
	Group B	Group A	-0.16667	0.90089	0.981	-2.3148	1.9815
		Group C	-1.43333	0.90089	0.255	-3.5815	0.7148
	Group C	Group A	1.26667	0.90089	0.342	-0.8815	3.4148
		Group B	1.43333	0.90089	0.255	-0.7148	3.5815
MAP_D10	Group A	Group B	8.20000*	0.87087	0	6.1234	10.2766
		Group C	8.26667*	0.87087	0	6.1901	10.3432
	Group B	Group A	-8.20000*	0.87087	0	-10.2766	-6.1234
		Group C	0.06667	0.87087	0.997	-2.0099	2.1432
	Group C	Group A	-8.26667*	0.87087	0	-10.3432	-6.1901
		Group B	-0.06667	0.87087	0.997	-2.1432	2.0099
MAP_BPN	Group A	Group B	7.80000*	0.75926	0	5.9896	9.6104
		Group C	7.83333*	0.75926	0	6.0229	9.6438
	Group B	Group A	-7.80000*	0.75926	0	-9.6104	-5.9896
		Group C	0.03333	0.75926	0.999	-1.7771	1.8438
	Group C	Group A	-7.83333*	0.75926	0	-9.6438	-6.0229
		Group B	-0.03333	0.75926	0.999	-1.8438	1.7771
MAP_APN	Group A	Group B	7.50000*	0.94948	0	5.236	9.764
		Group C	6.96667*	0.94948	0	4.7027	9.2307
	Group B	Group A	-7.50000*	0.94948	0	-9.764	-5.236
		Group C	-0.53333	0.94948	0.841	-2.7973	1.7307
	Group C	Group A	-6.96667*	0.94948	0	-9.2307	-4.7027
		Group B	0.53333	0.94948	0.841	-1.7307	2.7973
MAP_APN10	Group A	Group B	3.10000*	0.89223	0.002	0.9725	5.2275
		Group C	5.66667*	0.89223	0	3.5392	7.7942
	Group B	Group A	-3.10000*	0.89223	0.002	-5.2275	-0.9725
		Group C	2.56667*	0.89223	0.014	0.4392	4.6942
	Group C	Group A	-5.66667*	0.89223	0	-7.7942	-3.5392
		Group B	-2.56667*	0.89223	0.014	-4.6942	-0.4392
MAP_APN20	Group A	Group B	2.33333*	0.78278	0.01	0.4668	4.1999
		Group C	4.23333*	0.78278	0	2.3668	6.0999
	Group B	Group A	-2.33333*	0.78278	0.01	-4.1999	-0.4668
		Group C	1.90000*	0.78278	0.045	0.0335	3.7665
	Group C	Group A	-4.23333*	0.78278	0	-6.0999	-2.3668
		Group B	-1.90000*	0.78278	0.045	-3.7665	-0.0335
MAP_APN30	Group A	Group B	7.20000*	0.60162	0	5.7655	8.6345
		Group C	8.76667*	0.60162	0	7.3321	10.2012
	Group	Group A	-7.20000*	0.60162	0	-8.6345	-5.7655

	B	Group C	1.56667*	0.60162	0.029	0.1321	3.0012
	Group C	Group A	-8.76667*	0.60162	0	-10.2012	-7.3321
		Group B	-1.56667*	0.60162	0.029	-3.0012	-0.1321
MAP_APN40	Group A	Group B	8.90000*	0.97831	0	6.5672	11.2328
		Group C	10.30000*	0.97831	0	7.9672	12.6328
	Group B	Group A	-8.90000*	0.97831	0	-11.2328	-6.5672
		Group C	1.4	0.97831	0.33	-0.9328	3.7328
	Group C	Group A	-10.30000*	0.97831	0	-12.6328	-7.9672
		Group B	-1.4	0.97831	0.33	-3.7328	0.9328
MAP_APN50	Group A	Group B	6.76667*	0.71792	0	5.0548	8.4785
		Group C	10.96667*	0.71792	0	9.2548	12.6785
	Group B	Group A	-6.76667*	0.71792	0	-8.4785	-5.0548
		Group C	4.20000*	0.71792	0	2.4881	5.9119
	Group C	Group A	-10.96667*	0.71792	0	-12.6785	-9.2548
		Group B	-4.20000*	0.71792	0	-5.9119	-2.4881
MAP_APN90	Group A	Group B	3.20000*	1.04563	0.025	0.4104	5.9896
		Group C	5.20000*	1.04563	0.001	2.4104	7.9896
	Group B	Group A	-3.20000*	1.04563	0.025	-5.9896	-0.4104
		Group C	2	1.04563	0.177	-0.7896	4.7896
	Group C	Group A	-5.20000*	1.04563	0.001	-7.9896	-2.4104
		Group B	-2	1.04563	0.177	-4.7896	0.7896
MAP_RPN	Group A	Group B	7.20000*	0.90067	0	5.0524	9.3476
		Group C	7.93333*	0.90067	0	5.7857	10.081
	Group B	Group A	-7.20000*	0.90067	0	-9.3476	-5.0524
		Group C	0.73333	0.90067	0.695	-1.4143	2.881
	Group C	Group A	-7.93333*	0.90067	0	-10.081	-5.7857
		Group B	-0.73333	0.90067	0.695	-2.881	1.4143
MAP_AR	Group A	Group B	5.60000*	0.8311	0	3.6183	7.5817
		Group C	8.16667*	0.8311	0	6.1849	10.1484
	Group B	Group A	-5.60000*	0.8311	0	-7.5817	-3.6183
		Group C	2.56667*	0.8311	0.008	0.5849	4.5484
	Group C	Group A	-8.16667*	0.8311	0	-10.1484	-6.1849
		Group B	-2.56667*	0.8311	0.008	-4.5484	-0.5849
MAP_AR15	Group A	Group B	4.66667*	1.08188	0	2.0869	7.2464
		Group C	6.86667*	1.08188	0	4.2869	9.4464
	Group B	Group A	-4.66667*	1.08188	0	-7.2464	-2.0869
		Group C	2.2	1.08188	0.11	-0.3797	4.7797
	Group C	Group A	-6.86667*	1.08188	0	-9.4464	-4.2869
		Group B	-2.2	1.08188	0.11	-4.7797	0.3797
*. The mean difference is significant at the 0.05 level.							

Above table is showing inter-group statistical analysis of mean arterial pressure (mmHg) at different time intervals. There was significant ( $p < 0.05$ ) difference in mean arterial pressure seen in all values except baseline

(B), after intubation (D0), on comparing group A with group B. While on comparing groups A and C, significant ( $p < 0.05$ ) difference in mean arterial pressure was seen in all values except baseline (B) and after intubation (D0). On comparing group B with C, significant ( $p < 0.05$ ) changes in mean arterial pressure was present only after 20,30,90 minutes of pneumoperitoneum and after reversal (AR).

GRAPH-8



Above graph is showing variation in MAP at various intervals among three groups.

**TABLE-13**  
**COMPARISON OF SEDATION SCORE(RSSS)MEAN (± SD) AFTER EXTUBATION BETWEEN THREE GROUPS.**

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	F-value	p-value
				Lower Bound	Upper Bound				
RSSS Group A	30	1.43	0.57	1.22	1.65	1	3	6.893	0.002
Group B	30	1.73	0.69	1.48	1.99	1	3		
Group C	30	2.13	0.90	1.80	2.47	1	4		
Total	90	1.77	0.78	1.60	1.93	1	4		

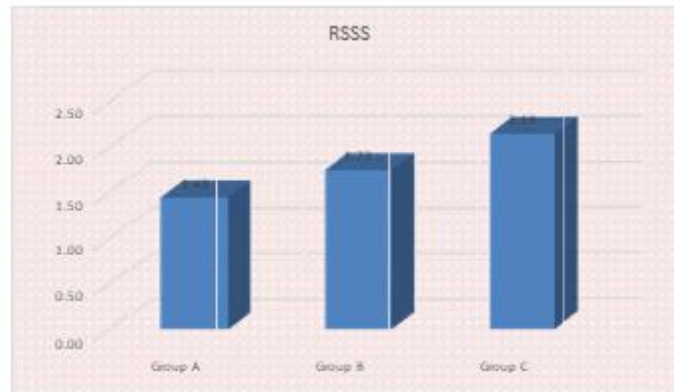
Above table shows that sedation score  $1.43 \pm 0.57$ ,  $1.73 \pm 0.69$  and  $2.13 \pm 0.9$  were observed in group A, B and C respectively. p-value is significant.

**TABLE -14**  
**INTER GROUP COMPARISON OF SEDATION SCORE(RSSS) AFTER EXTUBATION BETWEEN THREE GROUPS**

Tukey HSD							
Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
RSSS	Group A	Group B	-0.3	0.18917	0.257	-0.7511	0.1511
		Group C	-.70000*	0.18917	0.001	-1.1511	-0.2489
	Group B	Group A	0.3	0.18917	0.257	-0.1511	0.7511
		Group C	-0.4	0.18917	0.093	-0.8511	0.0511
	Group C	Group A	.70000*	0.18917	0.001	0.2489	1.1511
		Group B	0.4	0.18917	0.093	-0.0511	0.8511

Above table is showing inter-group statistical analysis of sedation score after extubation. There was significant difference in sedation score on comparing group A with group C. Whereas on comparing group A with group B and group B with group C, statistically insignificant difference was observed.

GRAPH-9



**TABLE -15  
ASA GRADING AMONG THREE GROUPS**

		Group			Total	Pearson Chi-Square	p-value
		Group A	Group B	Group C			
ASA	1	15	20	18	53	1.744	0.418
	2	15	10	12	37		
Total		30	30	30	90		

Above table shows ASA grading of patients among three groups.

**TABLE -16A  
NAUSEA AMONG THREE GROUPS**

		Group			Total	Pearson Chi-Square	p-value
		Group A	Group B	Group C			
Nausea	Present	1	0	0	1	2.022	0.364
	Absent	29	30	30	89		
Total		30	30	30	90		

**TABLE -16B  
VOMITING AMONG THREE GROUPS**

		Group			Total
		Group A	Group B	Group C	
Vomiting	Absent	30	30	30	90
Total		30	30	30	90

Above table shows, there was no complaint of vomiting in all the groups.

**TABLE -16C  
RESPIRATORY DEPRESSION AMONG THREE GROUPS**



		Group			Total
		Group A	Group B	Group C	
Res Dep	Absent	30	30	30	90
Total		30	30	30	90

Above table shows,there was no respiratory depression in all the groups.

**TABLE -16D  
BRADYCARDIA AMONG THREE GROUPS**

		Group			Total	Pearson Chi-Square	p-value
		Group A	Group B	Group C			
Bradycardia	Present	1	0	2	3	2.069	0.355
	Absent	29	30	28	87		
Total		30	30	30	90		

**TABLE -16E  
TACHYCARDIA AMONG THREE GROUPS**

		Group			Total	Pearson Chi-Square	p-value
		Group A	Group B	Group C			
Tachycardia	Present	1	0	0	1	2.022	0.364
	Absent	29	30	30	89		
Total		30	30	30	90		

Above table shows that tachycardia is present in groupA(3.33%), and absent in group B and group C.p-value is not-significant.

**TABLE -16F  
HYPOTENSION AMONG THREE GROUPS**

		Group			Total	Pearson Chi-Square	p-value
		Group A	Group B	Group C			
HypoTNS	Present	2	0	0	2	4.091	0.129
	Absent	28	30	30	88		
Total		30	30	30	90		

Above table shows that hypotension is present only in group A (6.66%).p-value is non-significant

**TABLE -16G  
HYPERTENSION AMONG THREE GROUPS**

		Group			Total	Pearson Chi-Square	p-value
		Group A	Group B	Group C			
HyperTNS	Present	2	0	0	2	4.091	0.129
	Absent	28	30	30	88		

Total	30	30	30	90		
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Above table shows that hypertension is present only in group A (6.66%). p-value is not-significant

**.TABLE -16H DESATURATION AMONG THREE GROUPS**

		Group			Total
		Group A	Group B	Group C	
Desaturation	Absent	30	30	30	90
Total		30	30	30	90

**. TABLE -16 I SHIVERING AMONG THREE GROUPS**

		Group			Total	Pearson ChiSquare	p-value
		Group A	Group B	Group C			
Shivering	Present	2	0	0	2	4.091	0.129
	Absent	28	30	30	88		
Total		30	30	30	90		

Above table shows that shivering is present in group A (6.66%).p-value is not- significant

**TABLE -16J URINARY RETENTION AMONG THREE GROUPS**

		Group			Total
		Group A	Group B	Group C	
Urinary retention	Absent	30	30	30	90
Total		30	30	30	90

## Discussion

Pneumoperitoneum used for laparoscopic procedure is a complex patho- physiologic phase with significant haemodynamic variation. Pneumoperitoneum (PNP) is produced by administration of carbon dioxide (CO<sub>2</sub>) during laparoscopic surgical procedure<sup>9-10</sup>. Both pneumoperitoneum and CO<sub>2</sub> cause adverse cardiovascular effects due to increase of plasma levels of epinephrine, nor-epinephrine, vasopressin, neurophysin and plasma renin activity increase<sup>22</sup>. All these changes contribute to increase in heart rate, arterial pressure, systemic and pulmonary vascular resistance and reduced cardiac output. In addition reverse trendelenburg position causes diminished venous return and reduction in cardiac output<sup>7</sup>.

Various studies have been done over the years for attenuating these unwanted detrimental effects which occur during pneumoperitoneum and intraoperative period. Drugs like beta blockers, magnesium sulphate, opioids, nitroglycerine, lidocaine, pregabalin, calcium channel blockers and gasless approach<sup>23</sup> to negate the haemodynamic variations. In modern anesthesia practice  $\alpha$ -2agonist due to their beneficial effects like sedation, analgesia, attenuation of stress response and reduction of anesthesia requirement has been studied to attenuation of these responses. Clonidine and dexmedetomidine are the two currently used drugs with dexmedetomidine having higher selectivity for alpha 2 receptors and a shorter half life<sup>17</sup>. Both these drugs significantly reduces the release of catecholamines, predominantly having an effect on systemic vascular resistance and improves intra and postoperative haemodynamic stability by stabilizing the changes in heart rate, arterial pressure, and cardiac output.

This study was conducted in 90 patients belonging to ASA grade I and II of either sex of age group 20 - 50 years scheduled for laparoscopic surgeries under general anesthesia who were randomly divided into three groups based upon computer generated randomization program.

According to our study, In clonidine group, the mean ( $\pm$ SD) HR (bpm) before induction was  $83.87 \pm 3.51$  bpm. On comparing with baseline values, increase in HR was observed immediately after intubation. Clonidine infusion was started immediately after intubation and mean HR 10 minutes afterward was similar to the baseline value. Increased HR was observed after release of pneumoperitoneum and after reversal. HR rate was similar to baseline value at APN10, APN30 and APN90. Joris JL et al observed the similar results with the use of clonidine as a premedication in a dose of  $8 \mu\text{g}/\text{kg}$ <sup>24</sup>. Kalra NK et al used clonidine  $1 \mu\text{g}/\text{kg}$  iv over a period of 15 minutes before pneumoperitoneum and observed significantly better haemodynamic control than control group<sup>25</sup>.

Roy S et al compared intravenous clonidine ( $2.25 \mu\text{g}/\text{kg}$  bolus and  $0.9 \mu\text{g}/\text{kg}/\text{hr}$  infusion) and iv lignocaine ( $1.5 \mu\text{g}/\text{kg}$  bolus and  $0.6 \mu\text{g}/\text{kg}/\text{hr}$  infusion) in laparoscopic hysterectomy. Attenuation in heart rate was significantly more in clonidine group<sup>26</sup>.

The mean ( $\pm$ SD) HR (bpm) before induction was  $80.90 \pm 2.22$  bpm in dexmedetomidine group. On comparing with baseline values increase in mean HR was observed immediately after intubation ( $94.60 \pm 4.77$  bpm). After infusion of loading dose of dexmedetomidine significant fall in mean HR was seen which remained similar to baseline values after creation of PNP. Further observations at regular time intervals after PNP that is APN10, APN30 and APN50 showed decrease in mean HR as compared to baseline values till the release of PNP. There was a slight increase in mean HR after reversal ( $83.10 \pm 3.00$  bpm) which was similar to baseline value, after which HR decreased to  $74.57 \pm 2.84$  bpm, 15 min after reversal.

Hazra JL et al observed the similar results with administered of iv clonidine  $1 \mu\text{g}/\text{kg}$ , iv dexmedetomidine  $1 \mu\text{g}/\text{kg}$  and normal saline in three different groups, 15 minutes prior to induction. There was significant reduction in mean heart rate at various intervals during pneumoperitoneum. These findings are very similar to our study which stated that dexmedetomidine provides better heart rate control as compared to clonidine and control group in laparoscopic surgeries<sup>27</sup>.

Bhattacharjee DP et al observed the similar results with the use of dexmedetomidine at an infusion rate of  $0.2 \mu\text{g}/\text{kg}/\text{hr}$  and observed that heart rate decreased significantly after intubation and pneumoperitoneum and remained lower throughout the pneumoperitoneum in comparison to control group ( $p < 0.01$ )<sup>28</sup>.

In our study dexmedetomidine was used as  $1 \mu\text{g}/\text{kg}$  iv over 10 minutes, after induction followed by maintenance infusion dose of  $0.2 \mu\text{g}/\text{kg}/\text{hr}$  and observed significant decrease in heart rate throughout the intraoperative period, when compared with control group.

On intergroup statistical analysis of mean HR of Group A and B at different time intervals, significantly ( $p < 0.05$ ) lower HR were observed in group B as compared to group A after infusion of loading dose of clonidine, after creation of PNP, 10, 30 and 50 minutes after PNP, after release of PNP, after reversal and 15 minutes after reversal. As infusion of clonidine was started only after intubation, the difference in heart rate between both groups at the time of intubation was statistically insignificant ( $p > 0.05$ ). Similar results were found in study done by Passi Y et al<sup>29</sup>, Hazra JL et al<sup>27</sup>, Das M et al<sup>30</sup>, Joris JL et al<sup>23</sup>, Roy S et al<sup>26</sup>.

Whereas on comparing group A with group C, significantly lower HR were observed in group C after infusion of loading dose of dexmedetomidine, after creation of PNP, 10, 30 and 50 minutes after PNP, after release of PNP, after reversal and 15 minutes after reversal ( $p < 0.05$ ). Similar results were found in study done by Hazra R et al<sup>27</sup>, Tufanogullari B et al<sup>31</sup> Bhattacharjee DP et al<sup>28</sup>

While comparing group B with group C, significantly ( $p < 0.05$ ) lower HR were observed in group C, after infusion of loading dose of dexmedetomidine, after creation of PNP, 10, 30 and 50 minutes after PNP, after release of PNP, after reversal and 15 minutes after reversal. Similar results were found in study done by Kumar S et al<sup>32</sup>, Hazra R et al<sup>27</sup>. As infusion of clonidine and dexmedetomidine were started only after intubation, the difference in heart rate between both groups at the time of intubation was statistically insignificant ( $p > 0.05$ ).

Above results clearly show that creation of pneumoperitoneum leads to significant increase in heart rate.  $\alpha$ -2 agonist drug clonidine and dexmedetomidine infusion before pneumoperitoneum at a dose of 2  $\mu\text{g}/\text{kg}$  loading followed by 2.0  $\mu\text{g}/\text{kg}$  maintenance infusion and 1.0  $\mu\text{g}/\text{kg}$  loading followed by 0.2  $\mu\text{g}/\text{kg}$  maintenance infusion respectively led to a sustained and significant fall in heart rate which led to a decrease in stress response following pneumoperitoneum. The mean HR was lower in dexmedetomidine as compared to clonidine and none of patient suffered from bradycardia and required dose reduction. Similar results were found in study done by Kumar S et al<sup>32</sup>, Hazra R et al<sup>27</sup>. When compared to various studies, our findings were similar to Aho et al<sup>33</sup> compared two doses of clonidine (3  $\mu\text{g}/\text{kg}$  and 4.5  $\mu\text{g}/\text{kg}$  IV) for attenuation of hemodynamic response to PNP. Rise in HR was less in both groups but significant bradycardia was observed in 4.5  $\mu\text{g}/\text{kg}$  group. Das M et al<sup>30</sup>, Gupta K et al<sup>34</sup> also used oral clonidine (150  $\mu\text{g}$ ) for maintaining haemodynamic stability during pneumoperitoneum and observed similar result. Roy S et al<sup>26</sup> compared iv clonidine (2.25  $\mu\text{g}/\text{kg}$  bolus and 0.9  $\mu\text{g}/\text{kg}/\text{hr}$  infusion) and iv lignocaine (1.5  $\mu\text{g}/\text{kg}$  bolus and 0.6  $\mu\text{g}/\text{kg}/\text{hr}$  infusion) in laparoscopic hysterectomy. Attenuation in heart rate was significantly more in clonidine group. All these studies administered clonidine (iv, im or oral) prior to induction, but in our study clonidine was administered after intubation and before pneumoperitoneum. So there was insignificant difference in heart rate in control group and clonidine group observed just after intubation. All studies supported the use of the safe dose of intravenous clonidine between 1-3  $\mu\text{g}/\text{kg}$ , which was similar to our study with no incidence of adverse effects.

Similar to clonidine, dexmedetomidine also attenuates the haemodynamic response to tracheal intubation, sympathoadrenal response occurring with pneumoperitoneum, decreases plasma catecholamine concentration during anesthesia and decreases perioperative requirement of inhaled anaesthesia<sup>35</sup>. Similar results were found in studies done by Bhattacharjee DP et al<sup>28</sup>, Lawrence CJ and Lange SD<sup>36</sup>

We studied the two most commonly used alpha 2 agonist in anesthesia practice and compared their efficacy in reduction of stress response and haemodynamic changes associated with laparoscopic cholecystectomy. In present study the mean heart rate was significantly lower in dexmedetomidine group as compared to clonidine group throughout the study ( $p < 0.05$ ). On comparing dexmedetomidine and clonidine, significant differences were present in all values of heart rate except baseline value and after intubation. The heart rate was lower in both groups as compared to baseline values and it was statistically significant ( $p < 0.05$ ). In spite of its more pronounced effect on heart rate, none of the patients receiving dexmedetomidine suffered severe bradycardia nor required any form of dose reduction. The heart rate lowering effect of both study drugs reduces the myocardial oxygen demand of the patient which is very useful in patients suffering from coronary artery disease and is more effective in this regard.

In present study the mean ( $\pm$ SD) SBP (mmHg) before induction was 125.73 $\pm$ 4.92 mmHg in control group. On comparing with baseline values, increase in SBP were observed immediately after intubation, APN and after RPN. During whole PNP, no significant changes in SBP at APN10, APN30, and APN50 ( $p > 0.05$ ). There was increase in SBP found after the reversal which decreased to baseline value, 15 minutes after reversal.

In clonidine group, the mean ( $\pm$ SD) SBP (mmHg) before induction was 120.87 $\pm$ 5.22 mmHg. On comparing with baseline values significant increase in SBP were observed immediately after intubation and APN. Significant fall in SBP was found after infusion of loading dose of clonidine at D10, APN20, APN30 and APN90 which were comparable to baseline value. Increased SBP was observed after release of PNP, after the reversal which decreased to baseline value, 15 minutes after reversal.

In dexmedetomidine group, the mean ( $\pm$ SD) SBP (mmHg) before induction was 124.97 $\pm$ 4.827 mmHg. On comparing with baseline values, increase in SBP was observed immediately after intubation. A significant fall in SBP was found after infusion of loading dose of dexmedetomidine (118.40 $\pm$ 4.55 mmHg) which remained lower even after creation of PNP, APN10, APN30 and APN50. After the release of PNP, SBP increased but still remained lower than the preinduction values, followed by an insignificant rise in SBP after the reversal (125.83 $\pm$ 3.67 mmHg) which decreased to 117.10 $\pm$ 3.46 mmHg, 15 minutes after reversal. On intergroup statistical comparison of mean SBP (mmHg) at different time intervals, significantly ( $p < 0.05$ ) lower SBP were observed in group B as compared to group A after infusion of loading dose of clonidine, after creation of PNP, 30 minutes after PNP, after release of PNP and after reversal. SBP was also found lower in group B at 10 and 50 minutes after PNP and 15 minutes after reversal but results were statistically insignificant ( $p > 0.05$ ).

On comparing group C with group A, fall in SBP were observed in all intervals in group C and this fall was significant ( $p < 0.05$ ) after infusion of loading dose of dexmedetomidine, after creation of PNP ,10,30 and 50 minutes after PNP, after release of PNP ,after reversal and 15 minutes after reversal.

Whereas on comparing group C with group B, the decrease in mean SBP appeared more in dexmedetomidine group at all intervals when compared with clonidine group ( $p > 0.05$ ) but the fall was found to be significant only after 50 minutes after pneumoperitoneum ( $p < 0.05$ ).

As infusion of clonidine and dexmedetomidine were started only after intubation, the difference in SBP between all the groups at the time of intubation were statistically insignificant ( $p > 0.05$ ). According to our study, the mean ( $\pm$ SD) DBP (mmHg) before induction was  $81.57 \pm 1.65$  mmHg in control group .On comparing with baseline values, increase in DBP were observed immediately after intubation, APN and after RPN. During whole PNP, no significant changes in DBP were observed as APN10 , APN30 , and APN50. There was increase in DBP found after the reversal which decreased to  $84.50 \pm 4.42$  mmHg, 15 minutes after reversal .

In clonidine group, the mean ( $\pm$ SD) DBP (mmHg) before induction was  $78.30 \pm 3.79$  mmHg. On comparing with baseline values, increase in SBP were observed immediately after intubation, APN and after RPN. Decrease in DBP found after infusion of loading dose of clonidine D10 ( $76.07 \pm 5.08$  mmHg) which remained lower throughout the PNP as shown by values APN10, APN30, and APN90 which were comparable to baseline value. There was increase in DBP after the reversal which decreased to  $79.80 \pm 4.89$  mmHg, 15 minutes after reversal. The mean ( $\pm$ SD) DBP (mmHg) before induction was  $80.00 \pm 3.54$  mmHg in dexmedetomidine group. On comparing with baseline values, increase in DBP was observed immediately after intubation. Decrease in DBP was found after infusion of loading dose of dexmedetomidine ( $74.23 \pm 2.55$  mmHg) which increased to  $80.70 \pm 4.08$  mmHg immediately after creation of PNP .During the whole PNP, fall in DBP were observed as shown by values APN10 ,APN30 and APN50. After the release of PNP, DBP increased to  $81.03 \pm 2.41$  mmHg followed by rise in DBP after the reversal ( $84.47 \pm 2.96$  mmHg) which decreased to  $77.70 \pm 7.04$  mmHg, 15 min after reversal .

On intergroup statistical analysis of mean DBP (mmHg) at different time intervals between Groups A and B, significantly lower DBP were observed in group B as compared to group A. On comparing group A with group C, a significant fall ( $p < 0.05$ ) in DBP were observed at all time intervals in group C and results were statistically significant ( $p < 0.05$ ).

Whereas on comparing group B with group C, The decrease in mean DBP values were more in group C at all intervals but this was statistically insignificant ( $p > 0.05$ ).

As infusion of clonidine and dexmedetomidine were started only after intubation, the difference in DBP between all the groups at the time of intubation were statistically insignificant ( $p < 0.05$ ).

According to our study the mean ( $\pm$ SD) MAP (mmHg) before induction was  $96.27 \pm 2.16$  mmHg in control group .On comparing with baseline values, increase in MAP were observed immediately after intubation, APN and after RPN. During whole PNP, insignificant changes in MAP were observed as shown by values APN10, APN30, and APN50 . There was increase in MAP found after the reversal ( $106.43 \pm 2.94$  mmHg) which decreased to  $97.67 \pm 3.52$  mmHg, 15 minutes after reversal .

In clonidine group, the mean ( $\pm$ SD) MAP (mmHg) before induction was  $92.31 \pm 3.41$  mmHg. On comparing with baseline values, increase in SBP were observed immediately after intubation and APN. Decrease in MAP was found after infusion of loading dose of clonidine ( $89.07 \pm 4.06$  mmHg) which remained lower throughout the PNP as shown by values APN10, APN20, APN30 ,and APN90 Increased MAP was observed at RPN after the reversal ( $100.83 \pm 3.59$  mmHg) which gradually decreased to  $93.00 \pm 3.79$  mmHg 15 minutes after reversal . The mean ( $\pm$ SD) MAP (mmHg) before induction was  $95.00 \pm 2.84$  mmHg in dexmedetomidine group. On comparing with baseline values increase in MAP was observed immediately after intubation.

Decrease in MAP found after infusion of loading dose of dexmedetomidine ( $89.00 \pm 2.36$  mmHg), during the whole PNP, APN10, APN30 and APN50 . After the release of PNP, MAP increased to  $94.30 \pm 3.27$  mmHg but still

remained higher after the reversal ( $98.27 \pm 3.08$  mmHg) which decreased to  $90.80 \pm 5.09$  mmHg, 15 min after reversal

On intergroup statistical analysis of mean MAP (mmHg) at different time intervals between Group B and A, significantly lower MAP were observed in group B as compared to group A after infusion of loading dose of clonidine, after creation of PNP, 10 and 50 minutes after PNP, after release of PNP, after reversal and 15 minutes after reversal ( $p < 0.05$ ). The MAP was also lower at 90 minutes after PNP in group B but statistically insignificant differences were observed ( $p > 0.05$ ).

On comparing group C with group A, fall in MAP were observed at time all intervals in group C and this fall was significant ( $p < 0.05$ ) after infusion of loading dose of dexmedetomidine, after creation of PNP, 30 and 50 minutes after PNP, after release of PNP, after reversal and 15 minutes.

Whereas on comparing group B with group C, the decrease in mean MAP appeared more in dexmedetomidine group at all time intervals but statistically insignificant difference observed ( $p > 0.05$ ). Significantly lower mean MAP was observed only after 50 minutes of pneumoperitoneum ( $p < 0.05$ ). As infusion of clonidine and dexmedetomidine were started only after intubation, the difference in mean MAP between the all groups at the time of intubation were statistically insignificant ( $p > 0.05$ ). The  $\alpha$ -2 agonists, including clonidine and dexmedetomidine, decrease central sympathetic outflow and modify intraoperative cardiovascular and endocrine responses. Results in our study clearly shows that pneumoperitoneum used in laparoscopy leads to significant increase of SBP, DBP and MAP in control groups whereas in clonidine and dexmedetomidine groups SBP, DBP and MAP remains near or lower than baseline values during pneumoperitoneum. Joris JL et al<sup>37</sup> observed that pneumoperitoneum results in an increase in MAP, SVR, PVR and decrease in cardiac output. The increase in SVR was associated with marked release of vasopressin and catecholamines. Clonidine ( $8 \mu\text{g}/\text{kg}$ ) given before pneumoperitoneum reduced the release of catecholamines and thus significantly attenuated the increase in MAP and heart rate in comparison to placebo.

Passi Y et al<sup>29</sup> observed that with oral clonidine ( $150 \mu\text{g}$ ) premedication 60-90 minutes before laparoscopy, change in MAP was significantly lower and MAP varied between  $88 \pm 9$  to  $95 \pm 9$  mmHg as compared to control group (vit B complex tablets) in which MAP varied between  $97 \pm 14$  to  $106 \pm 5$  mmHg. Gupta K et al<sup>34</sup> also observed similar findings.

In our study we used bolus  $2 \mu\text{g}/\text{kg}$  clonidine just after induction followed by  $2 \mu\text{g}/\text{kg}/\text{hr}$  maintenance infusion and observed no significant incidence of hypotension and bradycardia.

Roy S et al<sup>26</sup> used clonidine as  $2.25 \mu\text{g}/\text{kg}$  iv 15 minutes before induction followed by  $0.9 \mu\text{g}/\text{kg}/\text{hr}$  infusion intraoperatively while comparing iv clonidine with iv lignocaine. Arterial pressure was better controlled in clonidine group, with no episode of hypotension and bradycardia.

Our findings were also supported by Kalra et al<sup>25</sup> and Malek et al<sup>18</sup>. who studied two different doses of clonidine ( $1 \mu\text{g}/\text{kg}$  and  $2 \mu\text{g}/\text{kg}$ ). They observed that  $2 \mu\text{g}/\text{kg}$  clonidine provides better haemodynamic stress response control during pneumoperitoneum.

In present study mean sedation score after extubation was measured using Ramsay sedation score. The mean sedation score after extubation were 1.43, 1.73 and 2.13 respectively in group A, B and C. Statistically significant higher ( $p < 0.05$ ) sedation were observed in group C on comparing with group A and B whereas insignificant higher ( $p > 0.05$ ) sedation was observed in group B on comparing with group A. Similar results were found in study done by Kumar S et al<sup>32</sup>, they found that dexmedetomidine provided longer duration of analgesia and significantly higher sedation than clonidine.

Hypertension (6.66%), shivering (6.66%) and nausea (3.33%) was observed only in control group patients. Besides sedation, no untoward side effect occurred in both study drug groups. Sedation was more pronounced in dexmedetomidine group but did not cause any respiratory complications. None of the patients received any form of treatment and dose reduction for hypotension and bradycardia. Kumar S et al<sup>32</sup> observed higher sedation in dexmedetomidine when they compared IV clonidine and IV dexmedetomidine in laparoscopic cholecystectomy for attenuating stress response occurred during pneumoperitoneum. Bhattacharjee DP et al<sup>28</sup> also observed

higher sedation in dexmedetomidine group but it does not cause delay in the recovery time. Various studies suggest that anxiolytic, antishivering and sympatholytic properties of clonidine and dexmedetomidine prevent these untoward side effects.

## Conclusion

Following conclusions are drawn from the present study-

- Creation of pneumoperitoneum in laparoscopic abdominal surgeries produces significant increase of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP).
- Both intravenous clonidine and intravenous dexmedetomidine cause decrease in all haemodynamic parameters (HR, SBP, DBP and MAP) during pneumoperitoneum in laparoscopic abdominal surgeries.
- Dexmedetomidine and clonidine are equally effective in controlling blood pressure during pneumoperitoneum in laparoscopic surgeries but heart rate is better controlled by dexmedetomidine.
- No respiratory complications observed with both the drugs but dexmedetomidine produces higher sedation as compared to clonidine.
- No untoward effects or complications were observed with both study drugs

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