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## RESEARCH ARTICLE

# TO STUDY THE EFFICACY OF DEXMEDETOMIDINE FOR ATTENUATION OF HEMODYNAMIC RESPONSES IN PATIENTS UNDERGOING LAPAROSCOPIC SURGERIES

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**ABSTRACT**

**Background:** Hemodynamic stability during peri-operative period is of vital importance. The anaesthesiologist's conventional approach to provide anaesthesia for laparoscopic procedures has been the emphasis on maintaining hemodynamic stability by avoiding hypertension, hypotension and tachycardia.

**Objectives:**

To study

- Hemodynamic responses associated with Intubation and Pneumoperitoneum.
- Associated adverse effects like Bradycardia and hypotension.

**Methods**: Prospective double blinded randomized clinical study was conducted in the department of Anaesthesia. Ethical Committee permission- Taken Informed written consent- Taken

Total of 90 patients scheduled for Laparoscopic surgeries were allotted into two groups.

**Group D (Dexmedetomidine):** IV Dexmedetomidine loading dose 1mcg/kg and maintenance dose of IV Dexmedetomidine infusion at 0.4mcg/kg/min.

**Group S (Normal saline):** IV Normal saline 0.9% (1ml) loading dose and maintenance IV infusion at 1ml/min.

**Statistical Tests** used were Chi square test, unpaired t test and Mann-Whitney test.

**Inclusion criteria**

- Age 18-60 years of age.
- ASA grade I and II.

**Exclusion criteria**

- Patients with heart blocks
- Morbid obese.

**Results**:

| Time interval | **Group D** MAP in mm of Hg | **Group S** MAP in mm of Hg | P value |
|---|---|---|---|
| Baseline | 95.4 | 95.51 | 0.5643 |
| Intubation | 91.13 | 111.16 | <0.0001 |
| Pneumoperitoneum | 92.62 | 109.89 | <0.0001 |
| End of Pneumoperitoneum | 86.62 | 101 | <0.0001 |

**Conclusion**: Perioperative IV Dexmedetomidine was found to be effective in providing Hemodynamic stability during laparoscopic surgeries without any significant adverse effects.



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## INTRODUCTION

Hemodynamic stability during peri-operative period is of vital importance as there are many patients who have a compromised cardiovascular status and are on medications. The anaesthesiologist's conventional approach to provide an aesthesia for laparoscopic procedures has been the emphasis on maintaining hemodynamic stability by avoiding hypertension, hypotension and tachycardia. To prevent these adverse hemodynamic effects many interventions have been studied.

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They may be surgical interventions such as abdominal wall lift method (Laparotensors) providing gasless field for visualization, low intra-abdominal pressure techniques or use of Helium/Argon gas instead of $CO_2$. Anesthetic interventions to prevent such hemodynamic changes could be the use of various modes of anaesthesia such as epidural or spinal or combined epidural and general anaesthesia techniques for the procedure; or the use of various pharmacological drugs such as opioids, esmolol, sodium nitroprusside, nitroglycerine and alpha-2 adrenergic agonists. But the search for the ideal agent to control this instability in hemodynamics is still on. Dexmedetomidine is a selective $\alpha_2$ agonist with 16 times more specificity for alpha-2 receptors compared to clonidine. It has an elimination $t_{1/2}$ of 2-3 hours.

Intravenous administration of Dexmedetomidine before induction attenuates sympatho-adrenal response to laryngoscopy and intubation (Ghodki et al., 2012). This study is attempted to evaluate the efficacy of dexmedetomidine in blunting the neuro-endocrine response and subsequent hemodynamic changes that occur during laparoscopic surgeries.

## MATERIALS AND METHODS

A prospective double blinded randomized clinical study was conducted in the Department of Anaesthesiology after approval by the Medical Ethical Committee. The study was carried out on 90 patients belonging to American Society of Anaesthesiology (ASA) classification for physical status I and II of either sex in the age range of 18 to 60 years undergoing laparoscopic procedures under general anaesthesia. They were randomized into two groups of 45 each.

Group D - Dexmedetomidine Group

Group S - Control Group

**Inclusion criteria**

- Patients of age between 18 - 60 years
- ASA Grade I & II patients
- Type of surgery - elective laparoscopic surgeries
- Mallampati grade I and II
- Patients giving valid and informed consent.

**Exclusion criteria**

- Patients with anticipated difficult airway
- patients with conduction defects of the heart (heart blocks)
- Patients on beta blockers
- Patients with known allergy to the drug
- Pregnant women
- Morbidly obese (body mass index > 35 kg/$m^2$)

**Procedure:** The ethical clearance for the study was obtained from the Medical Ethical Committee of Hospital. Patients undergoing elective laparoscopic procedures, under general anaesthesia were screened for the eligibility. Patients fulfilling selection criteria were selected for the study and briefed about the nature of study and explained about anesthetic procedure in their vernacular language. A written informed consent was obtained from the patient. A preanesthetic evaluation with detailed medical history and systemic examination was done and relevant investigations were advised and reviewed on the previous day and on the day of surgery. Patients were randomized into two groups by computer generated slips:

- Group D patients received intravenous Dexmedetomidine Perioperatively. (Study group)
- Group S patients received intravenous normal saline 0.9% Perioperatively. (Placebo)

The study drug was provided as prefilled identical 1ml syringes for the loading dose and 50 ml syringes for the infusion dose containing study drugs, as per the randomization protocol, in dilutions of;

**For loading dose:**

- Dexmedetomidine - 1ml (100mcg/ml)
- Normal saline 0.9% - lml

**For infusion:**

- Dexmedetomidine - 50m1 (1mcg/ml)
- Normal saline 0.9% - 50ml

Patients were explained about the study, but did not know which drug was used. Two intravenous lines were secured, one 18 G intravenous i.v cannula in the right hand for infusion of the study drug and another 18G i.v cannula in the left hand for intravenous fluids and drug administration. After securing intravenous access, all patients were premedicated with inj. ranitidine 1mg/kg i.v and inj. Ondensetron 0.08mg/kg i.v, 500ml of crystalloids (Ringer Lactate) i.v was started. On arrival in the operation theater baseline monitors like ECG, Pulse-Oximeter and Non - Invasive Blood Pressure (NIBP) were attached. Baseline values of Heart rate (HR), Oxygen Saturation ($SPO_2$), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP) were noted. All patients received inj. Midazolam 0.04mg/kg i.v and inj. Glycopyrrolate 4 micrograms/kg i.v. The study drug was started 20 minutes prior to induction. Patients belonging to group D received a loading dose of dexmedetomidine at 1mcg/kg over 10minutes, followed by maintenance infusion of dexmedetomidine at the rate of 0.4mcg/kg/hr. Patients belonging to the Group S received normal Saline 0.9% at a similar rate as dexmedetomidine infusion.

All patients received inj. Fentanyl l.5mcg/kg i.v 5minutes prior to induction of general anaesthesia. Patients were pre-oxygenated with 100% $FiO_2$ for 5minutes. General anaesthesia was induced with inj. Propofol 2mg/kg i.v Inj. Succinylcholine 2mg/kg i.v was administered to Facilitate intubation. All patients were intubated with appropriate size cuffed Endotracheal Tubes. End - Tidal Carbon dioxide ($ETCO_2$) was monitored throughout the surgery and maintained between 35-40 mm of Hg by adjusting the minute ventilation. General anaesthesia was maintained on $O_2$, $N_2O$, Isoflurane and inj. Vecuronium bromide 0.08mg/kg. The maximum concentration of Isoflurane used was 1.5% Pneumoperitoneum was created slowly, starting at 2 litre/min, using $CO_2$ and the Intra Abdominal Pressure (IAP) was maintained between 12-14mm of Hg. Fall in MAP of more than 20% of basal MAP was treated with iv fluids and iv ionotropes. For rise in MAP more than 20% of baseline MAP and not being maintained within this limit with an isoflurane concentration of 1.5%, an NTG infusion was started to maintain the MAP. Heart rate less than 50 beats per minute (bmp) was treated with inj. Atropine 0.6mg i.v. On completion of surgery patients neuromuscular blockade was reversed using inj. Neostigmine 0.05mg/kg and inj Glycopyrrolate 0.008mg/kg. Patients were extubated and transferred to post operative recovery room and observed for the next one hour for any evidence of complications or adverse events in the first 24 hours were assessed.

**Hemodynamic Parameters including HR, $SPO_2$, SBP, DBP and MAP were noted at:**

- Preoperatively (M1)
- 10 minutes After starting the Study Drug (M2)

- At Induction (M3)
- During Intubation (M4)
- Before Pneumoperitoneum (M5)
- 10 minutes after Pneumoperitoneum (M6)
- 20 after Pneumoperitoneum (M7)
- 30 after Pneumoperitoneum (M8)
- Every 30 minutes till the end of Pneumoperitoneum
- At the end of Pneumoperitoneum (M9)
- 10 minutes after reversal (N1)
- Post operatively after 30minutes (N2)
- Study Drug infusion will be stopped 5 minutes before reversal.

## RESULTS

Our study comprised of 90 ASA I and II grading, undergoing elective laparoscopic surgeries, which were randomly divided into two groups: Group D and Group S comprising 45 patients each (Table 1). In group D, maximum number of patients i.e.28 (62.2%) were in the age group of 19-39 years, whereas 22 (49%) were in the age group of 40-60 years. In Group S, maximum number of patients i.e. 23 (51%) were in the age group of 40-60 years, whereas 17 (37.8%) were in the age group of 19-39 years. The mean age of all patients in group D was 37.06±11.56 years while that in group S was 37.77±11.78 (p=0.773, p>0.05). Thus both groups were statistically comparable as far as age was concerned. The number of females in group D was 19 and in group S was 25. The number of males in group D was 26 and in group S was 20 (P: 0.2058, P>0.05), thus the both groups were comparable statistically as far as sex is concerned.

The mean weight of patients in group D was 66.15±7.05 kg where as in group S it was 66.02±6.12 kg. (P: 0.903, P>0.05), thus the both groups were statistically comparable as far as body weight is concerned. The number of ASA grade I patients in group D were 32 and in group S were 37.The number of ASA grade II patients in group D was 13 and in group S were 8. Both groups were comparable as far as the ASA grading was concerned as the p value is 0.2127, (p value>0.05). Patients undergoing three types of laparoscopic surgeries were included in the present study- laparoscopic appendectomy, laparoscopic cholecystectomy and laparoscopic umbilical hernia repair (Table 2). 22(49%) patients in group D and 23(51%) patients in the group S underwent laparoscopic appendectomy. 14(31%) patients in group D and 13(29%) patients in group S underwent Laparoscopic cholecystectomy. 9(20%) patients in group D and 9(20%) patients in group S underwent laparoscopic umbilical hernia repair. P value was 0.7923 (p>0.05), which indicates that the three groups were comparable in terms of type of surgery the patients underwent. The average duration of PNP in group D was 58.18±24.27 min whereas in group S it was 56.42±56.42 min with a p value of 0.903 (p>0.05). The average duration of surgery (Sx) was 88.69±25.78 min and in group S it was 88.20±22.96 min, with a p value of 0.799 (p>0.05). Thus the duration of surgery and that of PNP were not significant in both the groups, making the groups comparable with respect to duration of surgery and PNP. Heart rate in Group S increased significantly when compared to Group D, after intubation (M4), before pneumoperitoneum (M5), 10 minutes after pneumoperitoneum (M6), 20 minutes after pneumoperitoneum (M7), 30 minutes after pneumoperitoneum (M8), at the end of pneumoperitoneum (M9), l0 minutes after reversal of

**Table 1. Demographic profile of both the groups**

| Demographic profile | Group d | Group s | p Value | Significance |
|---|---|---|---|---|
| **Age(Years)** | 37.06±11.56 | 37.77±11.78 | 0.773 | NS |
| **Gender(F:M)** | 19:26 | 25:20 | 0.206 | NS |
| **Weight(Kg)** | 66.15±7.05 | 66.02±6.13 | 0.903 | NS |
| **ASA Grades** | 32:13 | 37:8 | 0.213 | NS |

NS - Not Significant

**Table 2. Table showing types of surgeries included in the present Study**

| Type of Surgery | Group d | Group s | Total | Chi Square Test |
|---|---|---|---|---|
| **LA** | 22(49%) | 23(51%) | 45(50%) | P=0.7923 NS |
| **LC** | 14(31%) | 13(29%) | 27(30%) | |
| **LU** | 9(20%) | 9(20%) | 18(20%) | |
| **Total** | 45 | 45 | 90 | |

LA- Laparoscopic Appendectomy.
LC- Laparoscopic Cholecystectomy.
LU- Laparoscopic Umbilical Hernia Repair.
NS- Not Significant.

**Table 3. Table showing Heart Rate changes in both groups**

| Time interval | Group D | | Group S | | Mann-Whitney Test/Unpaired t test |
|---|---|---|---|---|---|
| | Mean | STD. Deviation | Mean | STD. Deviation | |
| M1 | 82.57 | 12.513 | 82.73 | 13.30 | P=0.865 NS |
| M2 | 81.89 | 13.85 | 84.16 | 12.48 | P=0.616 NS |
| M3 | 80.24 | 13.97 | 85.71 | 12.76 | P=0.047 S |
| M4 | 85.71 | 12.76 | 101.91 | 13.57 | P=0.001 S |
| M5 | 76.96 | 14.89 | 89.42 | 13.64 | P=0.001 S |
| M6 | 73.00 | 12.43 | 93.62 | 12.016 | P=0.001 S |
| M7 | 71.67 | 11.22 | 95.49 | 9.19 | P=0.001 S |
| M8 | 70.24 | 10.43 | 94.56 | 11.91 | P=0.001 S |
| M9 | 69.42 | 10.52 | 87.87 | 10.74 | P=0.001 S |
| N1 | 71.67 | 11.67 | 93.36 | 14.70 | P=0.001 S |
| N2 | 78.71 | 10.38 | 90.0 | 8.86 | P=0.001 S |

S - Significant, NS - Not Significant

**Table 4: Table showing Systolic Blood Pressure (SBP) changes in both the groups**

| Time Interval | Group D | | Group S | | Mann-Whitney Test/Unpaired T Test |
|---|---|---|---|---|---|
| | Mean | Std. Deviation | Mean | Std. Deviation | |
| M1 | 126.93 | 15.05 | 126.62 | 13.19 | P=0. 997 NS |
| M2 | 127.09 | 11.28 | 128.98 | 12.21 | P=0.354 NS |
| M3 | 109.09 | 15.29 | 121.44 | 14.31 | P=0.001 S |
| M4 | 121.16 | 15.43 | 147.69 | 21.07 | P=0.001 S |
| M5 | 112.49 | 12.43 | 130.04 | 18.12 | P=0.001 S |
| M6 | 117.49 | 13.55 | 144.20 | 12.67 | P=0.001 S |
| M7 | 116.60 | 12.03 | 139.69 | 10.20 | P=0.001 S |
| M8 | 114.29 | 9.14 | 139.31 | 10.07 | P=0.001 S |
| M9 | 113.71 | 10.24 | 131.98 | 10.35 | P=0.001 S |
| N1 | 120.27 | 10.72 | 137.56 | 10.72 | P=0.001 S |
| N2 | 122.02 | 8.97 | 132.91 | 10.56 | P=0.001 S |

NS - Not Significant, S - Significant

**Table 5. Table showing changes in the Diastolic Blood Pressure (DBP) in both the groups**

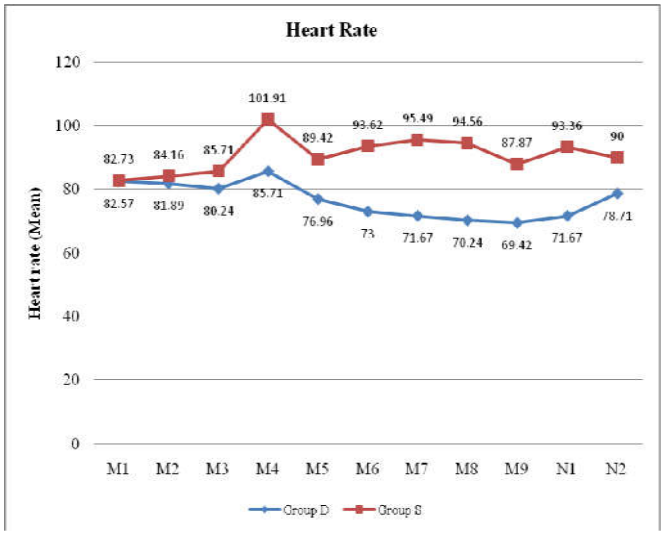
| Time Interval | Group d | | Group s | | Mann-whitney test/unpaired t test |
|---|---|---|---|---|---|
| | mean | std. deviation | mean | std. deviation | |
| M1 | 79.02 | 7.59 | 79.18 | 8.92 | P=0.777 NS |
| M2 | 78.49 | 7.49 | 81.69 | 9.619 | P=0.082 NS |
| M3 | 70.16 | 8.12 | 77.24 | 9.54 | P=0.001 S |
| M4 | 77.62 | 11.31 | 93.24 | 12.71 | P=0.001 S |
| M5 | 71.73 | 10.75 | 85.69 | 10.39 | P=0.001 S |
| M6 | 75.11 | 10.00 | 93.20 | 8.88 | P=0.001 S |
| M7 | 75.09 | 9.66 | 89.87 | 6.69 | P=0.001 S |
| M8 | 72.63 | 7.71 | 88.20 | 5.72 | P=0.001 S |
| M9 | 73.64 | 8.54 | 84.44 | 8.120 | P=0.001 S |
| N1 | 76.84 | 9.57 | 85.84 | 6.78 | P=0.001 S |
| N2 | 77.27 | 7.57 | 82.42 | 7.67 | P=0.001 S |

NS - Not Significant, S - Significant

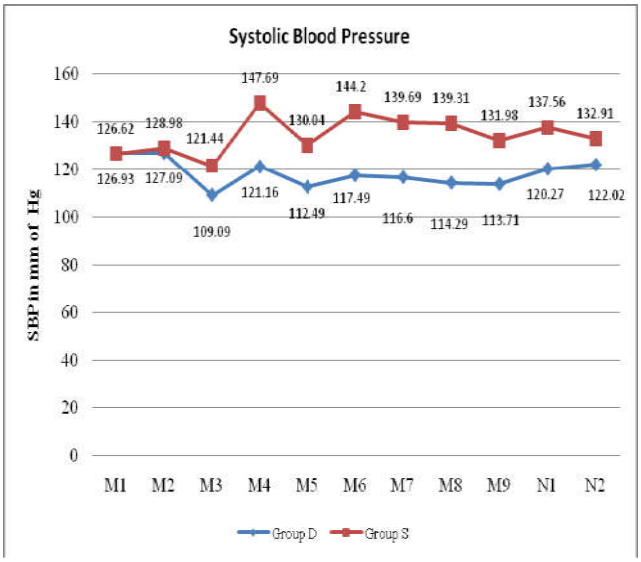
**Table 6. Table showing changes in the Mean Arterial Pressure (MAP) in both the groups**

| Time Interval | Group D | | Group S | | Mann-Whitney Test/Unpaired T Test |
|---|---|---|---|---|---|
| | Mean | STD. Deviation | Mean | STD. Deviation | |
| M1 | 95.4 | 9.28 | 95.51 | 9.81 | P=0.956 NS |
| M2 | 94.71 | 8.99 | 97.22 | 9.42 | P=0.199 NS |
| M3 | 83.02 | 10.32 | 91.56 | 11.39 | P=0.001 S |
| M4 | 92.62 | 12.41 | 111.16 | 14.82 | P=0.001 S |
| M5 | 85.18 | 10.369 | 101.47 | 10.39 | P=0.001 S |
| M6 | 91.13 | 9.60 | 109.89 | 8.81 | P=0.001 S |
| M7 | 88.91 | 9.61 | 106.69 | 7.483 | P=0.001 S |
| M8 | 86.84 | 8.11 | 106 | 5.72 | P=0.001 S |
| M9 | 86.62 | 6.59 | 101 | 8.12 | P=0.001 S |
| N1 | 91.56 | 9.15 | 103.69 | 8.78 | P=0.001 S |
| N2 | 92.13 | 6.89 | 99.4 | 7.83 | P=0.001 S |

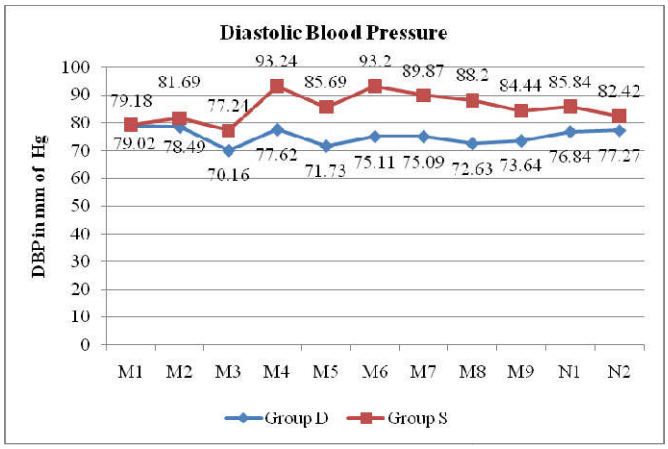
NS - Not Significant, S – Significant



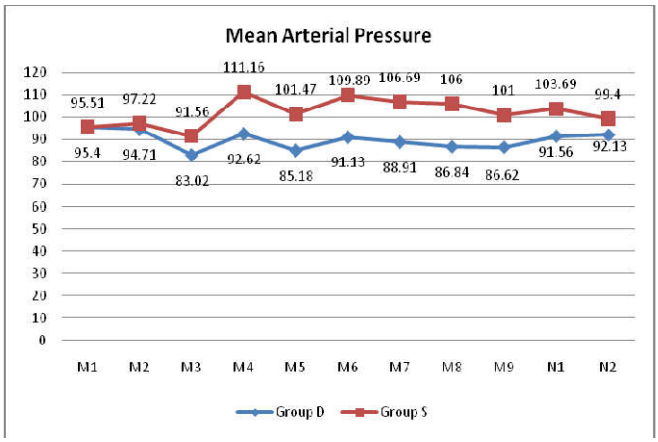

**Graph 1. Graph showing changes in the Heart Rate (HR) in both the groups**




**Graph 2. Graph showing changes in the Systolic Blood Pressure (SBP) in both the groups.**




**Graph 3. Graph showing changes in the Diastolic Blood Pressure (DBP) in both the groups**




**Graph 4. Graph showing changes in the Mean Arterial Pressures (MAP) in both the groups**

neuromuscular blockade (N1) and 30 minutes postoperatively (N2) ($p<0.05$) (Table 3) (Graph 1). Systolic Blood Pressure (SBP) in Group S increased significantly when compared to Group D, at induction (M3), after intubation (M4), before pneumoperitoneum (M5), l0 minutes after pneumoperitoneum (M6), 20 minutes after pneumoperitoneum (M7), 30 minutes after pneumoperitoneum (M8), at the end of pneumoperitoneum (M9), 10 minutes after reversal of neuromuscular blockade (N1) and 30 minutes postoperatively (N2) ($p<0.05$ ) (Table 4) (Graph 2). Diastolic Blood Pressure (DBP) in Group S increased significantly when compared to Group D, at induction (M3), after intubation (M4), before pneumoperitoneum (M5), l0 minutes after pneumoperitoneum (M6), 20 minutes after pneumoperitoneum (M7), 30 minutes after pneumoperitoneum (M8), at the end of pneumoperitoneum (M9), 10 minutes after reversal of neuromuscular blockade (N1) and 30 minutes postoperatively (N2) ($p<0.05$ ) (Table 5) (Graph 3). Mean Arterial Pressure (MAP) in Group S increased significantly when compared to Group D, at induction (M3), after intubation (M4), before pneumoperitoneum (M5), l0 minutes after pneumoperitoneum (M6), 20 minutes after pneumoperitoneum (M7), 30 minutes after pneumoperitoneum (M8), at the end of pneumoperitoneum (M9), 10 minutes after reversal of neuromuscular blockade (N1) and 30 minutes postoperatively (N2) ($p<0.05$ ) (Table 6) (Graph 4). Ten out of 45 patients (22%) required intra-operative NTG drip for control of hypertension in group S (placebo), whereas none of the patients in group D required NTG drip. p value was 0.0008 ($p<0.05$) and thus the difference is statistically significant. Four out of 45 (9%) patients in group D required inj. Atropine for the treatment of bradycardia (HR<50bmp). On the other hand none of the patients in the group S (placebo) required the use of atropine intraoperatively. p value was 0.0408 i.e. $p>0.05$, thus it is statistically significant. Six patients out of 45 (13%) of the group D experienced Post-Operative Nausea and Vomiting (PONV), while in Group S (placebo) 7 out of 45 patients (16%) experienced PONV. p value for PONV was 0.7643 which means ($p>0.05$), thus it is statistically not significant.

## DISCUSSION

Laparoscopic surgeries have become the gold standard for many surgical procedures. But laparoscopic surgery requires creation of Pneumoperitoneum by insufflation of carbon dioxide ($CO_2$) into the peritoneal cavity. Pneumoperitoneum has its own adverse effects due to raised intra-abdominal pressure (IAP), patient positioning and absorption of $CO_2$. Various anaesthetic techniques have also been used. Epidural, segmental spinal anaesthesia and epidural analgesia combined with general anaesthesia have been successfully used to attenuate the hemodynamic responses during laparoscopic procedures. Various drugs like esmolol, nitroglycerine, magnesium sulphate and alpha-2 adrenergic agonists like clonidine and dexmedetomidine have been used with varying degrees of success. Use of high doses of remifentanil almost completely prevents the hemodynamic changes. The alpha-2 adrenoreceptor exert a central sympatholytic action, improving hemodynamic stability in response to endotracheal intubation and surgical stress, reducing the anesthetic and opioid requirements and causing sedation, anxiolysis and analgesia.

### Hemodynamic Variables

**Heart Rate:** In the present study the mean heart rate of patients before receiving premedication, which was considered as the baseline heart rate, was 82.57±12.513 beats per minute (bpm) in group D, whereas it was 82.73±13.30 bpm in group S (Table 3). The mean heart rate varied from 69.42±10.52 to 85.71±l2.76 bpm in group D whereas it varied from 82.73±13.30 bpm to 101.91±13.57 bpm in group S.

Bhattacharjee *et al.* (2012) and Gourishankar *et al.* (2014) found that the heart rate significantly increased after laryngoscopy and endotracheal intubation and after creation of pneumoperitoneum. Studies by both the above authors found that perioperative inj dexmedetomidine infusion significantly reduced the heart rate after endotracheal intubation and pneumoperitoneum and remained lower throughout the period of pneumoperitoneum in comparison to placebo. In the present study we found significant decrease in the heart rate in Group D (dexmedetomidine) after laryngoscopy and endotracheal intubation and with the onset of pneumoperitoneum and throughout the period of pneumoperitoneum in comparison to group S (placebo). Ghodki *et al.* (2003) also found similar results in their study wherein there was a transient yet significant fall in the heart rate at the beginning of the dexmedetomidine infusion and that the heart rate was sustained for the entire duration of the infusion. In the present study 4 out of the 45 patients (9%) who received dexmedetomidine developed bradycardia (HR<50bpm), but responded well to treatment with anticholinergics (inj. Atropine sulphate 0.6 mg i.v). In several studies after IM and IV administration, in a small percentage of patients, dexmedetomidine caused

profound bradycardia (<40 bpm) and occasionally sinus arrest or pause. Generally, these episodes resolved spontaneously or were readily treated without adverse outcome by anticholinergics (Venn, 2003). Blood Pressure changes: In the present study the systolic blood pressure (SBP), the diastolic blood pressure (DBP) and the mean arterial pressure (MAP) in group S (placebo) were significantly higher than the baseline values during laryngoscopy, endotracheal intubation and throughout the period of pneumoperitoneum. Whereas in group D (dexmedetomidine) these values showed minimal variability from the baseline values during intubation and during the period of pneumoperitoneum. In group D there was a significant fall in the MAP values before induction, before pneumoperitoneum and after release of pneumoperitoneum. There was slight increase in values (<5%) after intubation, 15 and 30 minutes after pneumoperitoneum and after extubation. The values were significantly higher at all points of time in group S (Table 6). Upon statistical comparison of the two groups, there was a significant difference in values of both the groups (for SBP, DBP and MAP) at all points of time except before premedication where the values were comparable. There was a significant fall in the SBP, DBP and MAP in patients of group D before induction. It confirmed that 10 minutes is adequate for i.v. loading dose of dexmedetomidine to act (Table 4; 5; 6). Ghodki *et al*. (2012) in their study confirmed that after the loading dose of dexmedetomidine infusion there was a significant fall in the SBP. After which minimal change was observed for the entire duration of pneumoperitoneum.

Bhattacharjee DP *et al*. (2012) found that the MAP was significantly lower in the patients receiving dexmedetomidine infusion, in comparison to the placebo group, after induction, after intubation and pneumoperitoneum; and remained lower throughout the pneumoperitoneum and in the post-operative period. Gourishankar *et al*. (2014) when comparing two doses of dexmedetomidine infusion found that the MAP decreased significantly in the Dex 0.2 group and highly significantly in the dex 0.4 group below the pre-infusion levels. The increase in the MAP was significantly lower after intubation and extubation in the dex 0.2 group compared to the placebo group. MAP in the dex 0.4 group remained below pre-infusion levels after intubation and extubation, which is similar to the present study. Pneumoperitoneum did not produce a significant effect in both the dex groups. Tufanogullari *et al*. (2008) compared three infusion doses of Dexmedetomidine 0.2, 0.4 and 0.8mcg/kg/hr with saline in morbidly obese patients undergoing Laparoscopic Bariatric surgery. Although the intraoperative hemodynamic values were similar in the four groups, MAP values were significantly reduced in the Dex 0.2, 0.4, and 0.8 groups compared with the control group on admission to the postanesthesia care unit (PACU). In our study also, the mean arterial pressure in Dexmedetomidine group was significantly less in PACU. In group S, out of the 45 patients, 10 (22%) patients required intra-operative drip of inj. Nitroglycerine (NTG) for control of hypertension (defined as an increase of more than 20% in the MAP from the baseline not controlled by an isoflurane concentration of 1.5%). On the other hand none of the patients in group D required a NTG drip. Yildiz *et al*. (2006) evaluated the effect of a single pre-induction i.v. dose of dexmedetomidine 1mcg/kg on the cardiovascular response resulting from laryngoscopy and endotracheal intubation. They found that in the dexmedetomidine group the increase in blood pressure and heart rate after tracheal intubation was significantly lower as compared to the placebo group. Sulaiman *et al*. (2012) studied the efficacy of i.v. dexmedetomidine (0.5mcg/kg given 10 minutes prior to induction) for attenuation of cardiovascular responses to laryngoscopy and endotracheal intubation in patients with coronary artery disease. They too found that dexmedetomidine at a dose of 0.5mcg/kg as l0 minute infusion, administered prior to induction of general anaesthesia, attenuates the sympathetic response to laryngoscopy and intubation in patients undergoing myocardial revascularization. Cho *et al* also had similar findings when using i.v. dexmedetomidine pre-treatment in the doses of 0.5mcg/kg or 1.0mcg/kg. Dexmedetomidine suppressed sympathetic hyperactivity and attenuated QTc prolongation during intubation. Aantaa *et al*. (1997) found decreased BP and heart rate during intubations following the administration of 0.6 pg/kg bolus of dexmedetomidine preoperatively. Lawrence *et al*. (1997) found decreased hemodynamic response to tracheal intubation or extubation following a single high dose of dexmedetomidine (2mcg/kg). Isoflurane requirement was found to be significantly less in Group D as compared to Group S. The requirement of isoflurane was significantly higher in Group S. Khan *et al*. (1999) studied the effects of dexmedetomidine on isoflurane requirements in healthy volunteers. They concluded that dexmedetomidine decreased isoflurane requirements in a dose dependent manner. Tufanogullari *et al*. (2008) also found reduced average end-tidal desflurane concentrations with dexmedetomidine infusions. Ghodki *et al*. (2012) in their study found that dexmedetomidine infusion reduced the end-tidal concentration of isoflurane requirement for maintenance of anaesthesia by 30%, while maintaining adequate depth of anaesthesia.

**Post-operative nausea and vomiting (PONV):** Post-operative nausea vomiting occurred in 6 out of 45 patients (13%) in group D, whereas it occurred in 7 out of 45 (16%) patients in group S. P value was 0.764 (P >0.05), and thus the difference was statistically not significant. Our findings did not correlate with the study by Tufanogullari *et al*. (2008) in which 70% of the patients in the placebo group suffered from PONV while only 30% patients in the dex 0.2 and dex 0.4 group suffered from PONV. Only 10% of the patients of the dex 0.8 group suffered from PONV. This may be because all our patients already received inj. Ondensetron and inj. Ranitidine as premedication.

## Conclusion

In the present study effects of $CO_2$ pneumoperitoneum on hemodynamics and the efficacy of intravenous dexmedetomidine infusion to prevent the same were assessed. The conclusions drawn from the study are:

- $CO_2$ pneumoperitoneum causes activation of the sympathetic autonomic nervous system leading to hemodynamic perturbations.
- Perioperative intravenous dexmedetomidine as a loading dose of 1mcg/kg/hr over 10mins prior to induction, followed by an infusion of 0.4mcg/kg/hr in ASA I and II patients was found to be effective in providing intraoperative hemodynamic stability during laparoscopic surgeries without any significant adverse effects.
- In addition, dexmedetomidine also blunted the stress responses to laryngoscopy & endotracheal intubation and extubation.

- The intraoperative requirement of NTG was decreased by administration of i.v. dexmedetomidine.

Hence dexmedetomidine can be safely used to attenuate the hemodynamic responses during laparoscopic surgeries with the added advantage of it being an adjuvant to general anaesthesia. However additional studies are necessary to ascertain the efficacy and safety of dexmedetomidine in elderly and ASA III and IV patients, particularly in those with compromised cardiovascular function.

**Conflict of Interest:** Nil

**Financial Disclosure:** Nil

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