Scholars Journal of Applied Medical Sciences (SJAMS)
Abbreviated Key Title: Sch. J. App. Med. Sci.
ISSN 2320-6691 (Online)
ISSN 2347-954X (Print)

A Unit of Scholars Academic and Scientific Society, India
www.saspublishers.com

Anaesthesiology

A Comparative Evaluation of Intravenous Dexmedetomidine on Haemodynamic Stress Response during Pneumoperitoneum in Laparoscopic Abdominal Surgeries

Sandeep Kothiya, Nidhi Sharma*
Department of Anaesthesiology, G.R. Medical College, Gwalior, M.P, India

Original Research Article

***Corresponding author**
Nidhi Sharma

Article History
Received: 15.07.2018
Accepted: 23.07.2018
Published: 01.08.2018

DOI:
10.36347/sjams.2018.v06i08.021

Abstract: Laparoscopic surgeries because of their benefits like small incision and pain due to it, early mobility, less infection rate, less postoperative analgesics usage etc. are preferred over open surgical procedures. But laparoscopic procedures also causes complications because of pneumoperitoneum created during surgeries by insufflattion of gases and its duration leads to blood pressure and heart rate changes. Various drugs of different groups are used to reduce the effect of pneumoperitoneum. Dexmedetomidine is a selective α- 2 agonists used for the same purpose with its various other benifits too. This randomized control study was conducted on 60 patients of ASA grade 1 and 2 after taking ethics committee approval. Group D (n=30) dexmedetomidine is infused during the surgery and in group C (n=30) normal saline is infused during the surgery. Diastolic and systolic blood pressure, mean arterial blood pressure and heart rate were measured throughout the procedure till 30 minutes after the procedure. Sedation score was also measured after the surgery. Effect of intubation and laryngoscopy induced stress response, creation of pneumoperitoneum, reversal of pneumoperitoneum and extubation was seen over heart rate, SBP, DBP and MAP in both the groups but was significantly less in the dexmedetomidine group(D) compared to the control(C) group showing better stability of the hemodynamic vitals in the patients given dexmedetomidine intraoperatively ($P<0.05$). Dexmedetomidine suppresses pneumoperitoneum induced hemodynamic instabilities in patients undergoing laparoscopic cholecystectomy under general anaesthesia.
Keywords: Blood pressure, Dexmedetomidine, General anaesthesia, Heart rate, Sedation.

INTRODUCTION

When compared to open surgery, laparoscopic approach is safer and has several benefits over the former [1, 2]. Laparoscopic abdominal surgeries have less complication and mortality rate when compared to open procedure [3]. For laparoscopic abdominal surgeries, hemodynamic instability are more during the duration of pneumoperitoneum (PNP)[4, 5] namely carbon dioxide (mainly CO2) insufflations and patient positioning[6,7].

The cardiopulmonary changes that occur during laparoscopyare characterized by decreased cardiac output, increased arterial pressures, increased systemic vascular resistance (SVR) and pulmonary vascular resistance (PVR)[8, 9]. Pneumoperitoneum decreases thoracopulmonary compliance by 30-50% [10]. Positioning during laparoscopic cholecystectomy causes diaphragm to elevate and thus decreases the FRC [11], airway pressure increases [12] and atelectasis also occurs.

To attenuate these responses, various pharmacological drugs are used like adrenoreceptorblockers[13], beta blockers[14], Ca channel blocker, lidocaine[15], opioids[16], pregabalin[17], magnesium sulfate[18], vasodilators[19], remifentanil[20]. Dexmedetomidine is highly selective and potent specific α- 2 agonist [21] and has shorter duration of action (2-3 hr) [22]. Dexmedetomidine attenuates the haemodynamic response to tracheal intubation, decrease plasma catecholamine and norepineprine concentrationand thus maintain blood pressure and heart rate [23] and also decreases perioperative requirements of inhaled anaesthetics during anaesthesia[24]. Dexmedetomidinealso reduces the opioid requirements during pneumoperitoneum in laparoscopic surgeries.

MATERIALS & METHODS

After obtaining approval from the ethics committee and well written informed consent from the patients, study was carried out on 90 patients of ASA grade I and II, aged 20-50 years, undergoing laparoscopic cholecystectomy lasting 1-3 hours

requiring general anaesthesia with endotracheal intubation at J.A Group of Hospitals of G.R. Medical College, Gwalior (M.P), India. Patients were allocated randomly using envelope technique in two groups of 30 each. In group C, normal saline is infused and it is a control group while in group D, Dexmedetomidineis infused during the surgery.

Exclusion Criteria were **:** ASA grade III and above, BMI>30,patients undergoing Laparoscopic to open surgery conversion intraoperatively, pneumoperitoneum duration >90 minutes, known history of allergy or sensitivity or any other reaction to study drug, 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.

Consent

Details of procedure were explained to all the patients during preanaesthetic assessment and an informed and written consent was obtained.

Patients' grouping

90 patients of ASA grade I & II of either sex scheduled for abdominal surgeries under general anaesthesia were divided into 2 groups (n=30 each) randomly using envelope technique as below:

Group C (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 D (n=30)	Dexmedetomidine1µg/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 0.2 µg/kg/hr.

Preparation of the patient

Upon arrival of the patient in the operation room, intravenous access with 18G cannula was established and 500 mL of crystalloid infusion was started. All the baseline vital parameters (HR, SBP, DBP, MAP), electrocardiography using three lead ECG were monitored. Oxygen saturation (SPO2) was monitored by using pulse oximeter. End tidal Carbon dioxide was monitored intraoperatively and kept between 25 and 30 mmHg.

Anaesthesia procedure and recording

Drugs were administered by a person who was not involved in the study to avoid bias. Patients were preoxygenated with 100% oxygen at appropriate flow for 3 minutes by facemask. After premedication with i.v.InjPentazocine0.5mg/kg, general anaesthesia was induced with i.v.InjThiopentone Sodium 5 mg/kg body weight. Endotracheal intubation was facilitated with i.v. Inj. Succinylcholine 1.5 mg/kg body weight and IPPV was done for 60 seconds with 100% oxygen.

Laryngoscopy was done with laryngoscope having Macintosh blade and tracheal intubation done with appropriate size of cuffed endotracheal tube. Cuff was inflated and bilateral equal air entry was checked and then tube was fixed.

General anaesthesia was maintained with nitrous oxide & oxygen (67:33) and Isoflurane (0.5-1%) with Bain's anaesthetic circuit. Loading and intermittent dosage of non-depolarizing muscle relaxant, IV AtracuriumBesylate0.5mg/kg body weight initially followed by increment doses at 0.1mg/kg was used to maintain general anaesthesia under controlled ventilation throughout the surgical procedure. After intubation, the infusion of Dexmedetomidine (1 µg/kg) in 50 mL normal saline or 50 mL normal saline was started 10 min before induction of pneumoperitoneumThis was followed by a continuous infusiondexmedetomidine 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.

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_0, D_{10}, BPN, APN, APN_{10}, APN_{20}, APN_{30}, APN_{40}, APN_{50}, APN_{60}, APN_{90},RPN, AR, AR_{15}, AR_{30}, intervals. PNP -Pneumoperitoneum, B- Basal value (0 minute), D_0- Before study drug, D_{10}- After study drug, BPN-Before pneumoperitoneum, APN- After pneumoperitoneum, RPN- Release of pneumoperitoneum, AR- After reversal.

All the study drugs were stopped once surgical procedure was over and pneumoperitoneum was released. After surgery, patients were reversed with Inj. Glycopyrrolate0.005mg/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 (± 20% of basal value), hypotension / hypertension (± 20% of basal value), bradyarrythmia& 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

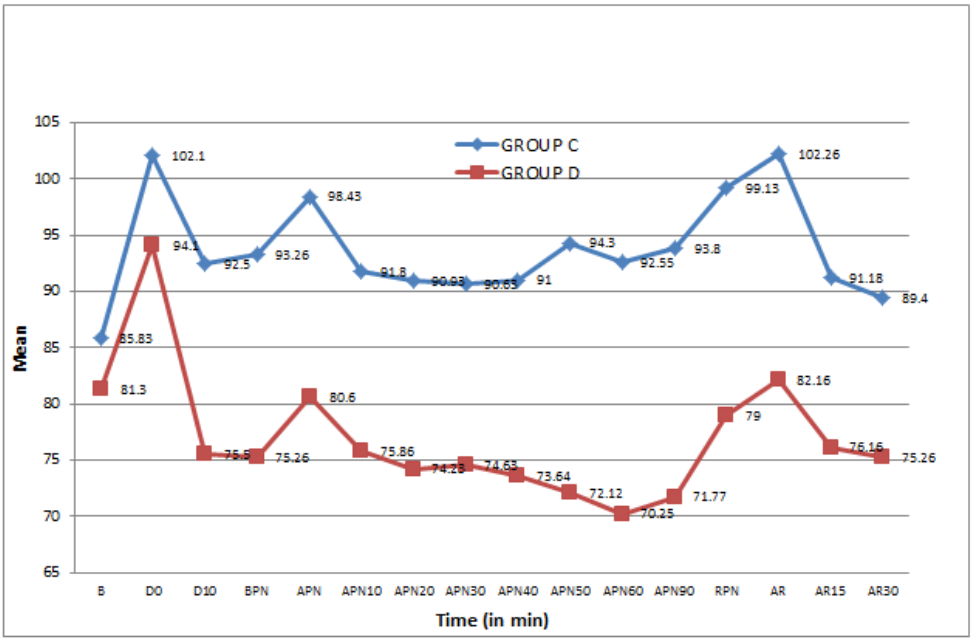
The observations were recorded and subjected to statistical analysis using students "t" test by statistics calculator SPSS 17. Student 't'-test for inter group comparison was used. p-value >0.05 was taken to be statistically insignificant & p-value <0.05 was taken statistically significant and p-value <0.01 taken to be statistically highly significant.

RESULTS

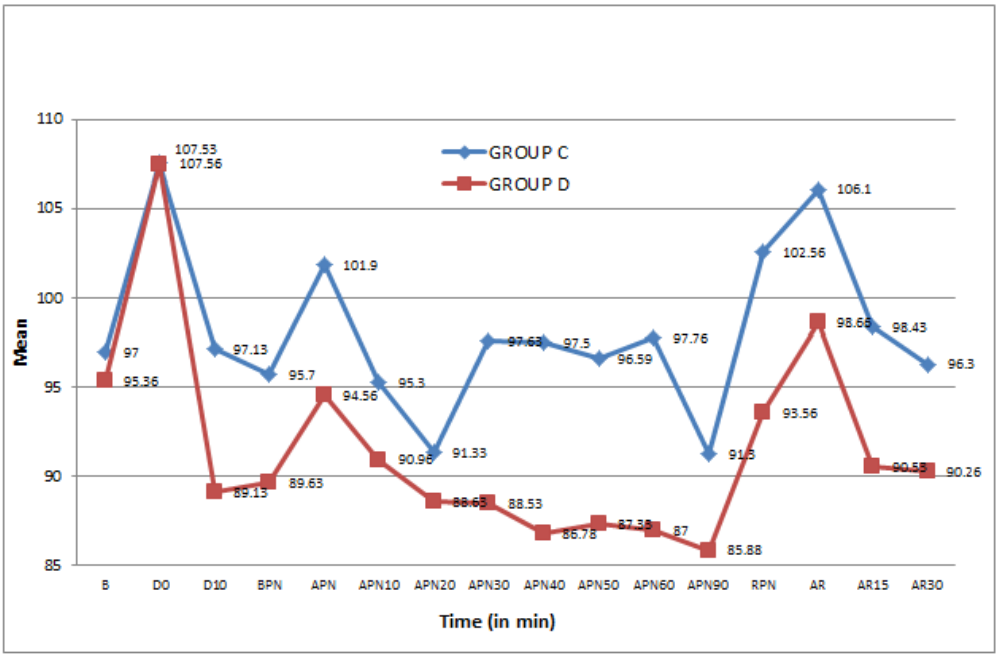
Data obtained from the patients involved in the study were analyzed. The mean age, weight, sex, type of surgery, duration of pneumoperitoneum, duration of anaesthesia, type of surgery and Ramsay sedation score after extubation were comparable in two study groups as shown in table Preoperative heart rate, systolic, diastolic and mean blood pressure and blood sugar level were comparable in all the two groups.

Table -1: Showing demographic variables of two groups

DEMOGRAPHIC DATA	Group C	Group D
Age	34.43±8.75	36.53±7.85
Weight (Kg)	53.23±7.20	50.90±5.28
Sex (Female)	73.33%	97.67%
Duration Of Pneumoperitoneum (Min)	62.96±18.14	62.73±17.80
Duration Of Anaesthesia (Min)	89.16±19.47	91.16±18.36
Type Of Surgery Laparoscopic Cholecystectomy	93.33%	100%
Laparascopic Hernia	6.67%	-
Ramsay Sedation Score After Extubation (Mean+Sd)	1.43±0.56	2.20±0.96



Graph-1: Statistical analysis of mean pulse rate (bpm)



Graph-2: Statistical analysis of mean (± SD) mean arterial pressure (mmHg)

DISCUSSION

Pneumoperitoneum used for laparoscopic procedure which is produced by insuflation of carbon dioxide (CO_2) causes significant haemodynamicvariation [8,9] like adverse cardiovascular effects due to increase of plasma levels of epinephrine, nor-epinephrine, vasopressin, neurophysin and plasma renin activity increase[26]. These changes in turn contribute to increase in heart rate, arterial pressure, systemic and pulmonary vascular resistance and reduced cardiac output. In addition trendelenburg position causes reduction in cardiac output due to decrease in venous return[6].

To attenuate these responses, various pharmacological drugs are used like adrenoreceptorblockers[13], beta blockers[14], Ca channel blocker, lidocaine[15], opioids[16], pregabalin[17], magnesium sulfate[18], vasodilators[19], remifentanil[20].

Nowadays, α-2agonist due to their beneficial effects like sedation, analgesia, attenuation of stress response and reduction of inhalational agentsrequirement has been studied to attenuate laparoscopy related adverse responses. Dexmedetomidine is one such drug of alpha-2 agonist category that 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.

The present studywas conducted to evaluate and compare the effects and efficacies of dexmedetomidine on HR, SBP, DBP and MAP during pneumoperitoneum. This study was also aimed to observe any untoward effects of study drugs and effect on sedation after extubation. Selected groups were comparable for the demographic variables like age and weight parameters, type of surgery, sex, duration of pneumopeitoneum and duration of anaesthesia with P> 0.05. Effect of intubation and laryngoscopy induced stress response, creation of pneumoperitoneum, reversal of pneumoperitoneum and extubation was seen over heart rate, SBP, DBP and MAP in both the groups but was significantly less in the dexmedetomidine (D) group compared to the control(C) group showing better stability of the hemodynamic vitals in the patients given dexmedetomidineintraoperatively.

Hazra R *et al.* [27] conducted a study in which they administered iv clonidine 1µg/kg, iv dexmedetomidine 1µg/kg and normal saline in three different groups, 15 minutes prior to induction. They observed significant reduction ($p<0.05$) in heart rate after intubation, 10, 20 and 30 minutes after pneumoperitoneum, after release PNP and after extubation in dexmedetomidine group compared to clonidine and control group. 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.

Lawrence CJ and Lange SD [28] used 2 µg/kg iv dexmedetomidine and observed that intraoperative heart rate variability, postoperative analgesia and perioperative serum catecholamine concentration were significantly less in dexmedetomidine group($p<0.05$). They also found that isoflurane requirement was significantly less in dexmedetomidine group as

compared to placebo group (24% and 72% respectively). In our study we observed requirement of inhalational agent was significantly reduced in dexmedetomidine group as compared to control group.

SwaikaS *et al*.[29] supported the use of dexmedetomidine in laparoscopic surgery for attenuating haemodynamic response on comparing dexmedetomidine iv (1µg/kg bolus and 0.2-0.4 µg/kg/hr infusion) and paracetamol iv.

GhodkiPK *et al*. [30] studied similar doses as used in our study i.edexmedetomidine 1 µg/kg over 15 minutes followed by maintenance infusion of 0.2 µg/kg/hr and observed significant reduction ($p<0.05$) in blood pressure during pneumoperitoneum. They also didn't observe any incidence of bradycardia.

Tuffanogullari B *et al*.[31] compared three infusion dose of dexmedetomidine 0.2, 0.4 and 0.8 µg/kg/hr with saline in morbidly obese patients, undergoing laparoscopic bariatric surgery. It was found that intraoperative haemodynamic values were similar in the four groups, arterial blood pressure values were significantly reduced in the dexmedetomidine 0.2, 0.4 and 0.8 groups compared with the control group.

CONCLUSION

Study conducted can be concluded as the 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) and dexmedetomidine by decreasing these responses, stabilizes all haemodynamic parameters (HR, SBP, DBP and MAP) during pneumoperitoneum in laparoscopic abdominal surgeries.

REFERENCES

1. Matovic E, Hasukic S, Ljuca F, Halilovic H. Quality of life in patients after laparoscopic and open cholecystectomy. Med Arch 2012; 66(2):97-100.
2. Leonard IE, Cunningham AJ. Anesthetic considerations for laparoscopic cholecystectomy. Best Pract Res ClinAnaesthesiol 2002;16(1):1-20.
3. Osborne DA, Alexander G, Boe B, Zervos EE. Laparoscopic cholecystectomy: past, present and future. SurgTechnolInt. 2006; 15:81-5.
4. Hodgeson G, MC Clelland RMA, Newton JR. Some effects of the peritoneal insufflation of carbon-dioxide. Anaesthesia. 1970; 25:382-389.
5. Blobner M, Felber AR, Gögler S, Feussner H, Weigl EM, Jelen G, Jelen-Esselborn S. The resorption of carbon dioxide from the pneumoperitoneum in laparoscopic cholecystectomy. Der Anaesthesist. 1993 May;42(5):288-94.
6. Richardson JD, TrinkliEK. Haemodynamic and respiratory alterations with increased intra abdominal pressure. J Surg Res 1976; 20(5):401-4.
7. JorisJL, Noirot DP, LegrandMJ, Jacquet NJ, Lamy ML. Hemodynamic changes during laparoscopic cholecystectomy. AnesthAnalg 1993;76(5):1067-71.
8. Safran DB, Orlando R. Physiological effects of pneumoperitoneum. Am J Surg 1994; 167(2):281-6.
9. Ivankovich AD, Miletich DJ, Albrecht RF,HeymanHJ, Bonnet RF. Cardiovascular effects of intraperitonealinsuffulation with carbon dioxide insuffulation and nitrous oxide in the dog. Anesthesiology 1975;42(3):281-7.
10. Struthers AD, Cuschieri A: Cardiovascular consequences of laparoscopic surgery. The Lancet 1998;352(9127):568-570.
11. Bardoczky GI, Engelman E, Levarlet M, Simon P. Ventilatory effects of pneumoperitoneum monitored with continuous spirometry. Anaesthesia. 1993 Apr;48(4):309-11.
12. Fahy BG, Barnas GM, Flowers JL, Nagle SE, NjokeMJ. The effects of increased abdominal pressure on lung and chest wall mechanics during laparoscopic surgery. AnesthAnalg. 1995;81(4):744-50.
13. Anderson LE, Baath M, Thorne A, Aspelin P, odenberg-Wernermans S. Effect of carbon dioxide pneumoperitoneum on development of atelectasis during anesthesia, examined by spiral computed tomography. Anesthesiology 2005;102(2):293-9.
14. JorisJL, Chiche JD, CanivetJL, Jacquet NJ, LegrosJJ, Lamy ML. Hemodynamic changes induced by laparoscopy and their endocrine correlates: Effects of clonidine. J Am CollCardiol 1998; 32(5):1389-96.
15. Koivusalo AM, Scheinin M, Tikkanen I, Yli-Suomu T, Ristkari S, Laakso J, Lindgren L. Effects of esmolol on haemodynamic response to CO2 pneumoperitoneum for laparoscopic surgery. Acta anaesthesiologica scandinavica. 1998 May;42(5):510-7.
16. De Oliveira GSJr, Fitzgerald P, Streicher LF, Marcus RJ, McCarthy RJ. Systemic lidocaine to improve postoperative quality of recovery after ambulatory laparoscopic surgery. AnesthAnalg. 2012; 115(2):262-7.
17. Lentschener C, Axler O, Fernandez H, Megarbane B, Billard V, Fouqueray B, Landault C, Benhamou D. Haemodynamic changes and vasopressin release are not consistently associated with carbon dioxide pneumoperitoneum in humans. Acta anaesthesiologica scandinavica. 2001 May;45(5):527-35.
18. Gupta K, Sharma D, Gupta PK. Oral premedication with pregabalin or clonidine for hemodynamic stability during laryngoscopy and laparoscopic cholecystectomy: A comparative

evaluation. Saudi journal of anaesthesia. 2011 Apr;5(2):179.
19. Jee D, Lee D, Yun S, Lee C. Magnesium sulphate attenuates arterial pressure increase during laparoscopic cholecystectomy. Br J Anaesth 2009;103(4):484-9.
20. Feig BW, Berger DH, Dougherty TB, Dupuis JF, Hsi B, Hickey RC. Pharmacological interventions can reestablish baseline hemodynamic parameters during laparoscopy. Surgery. 1994; 116(4):733-9.
21. Maze M, Tranquilli W. Alpha-2 adrenoceptor agonists: defining the role in clinical anesthesia. Anesthesiology.1991;74(3):581–605.
22. Roy S, Chaudhary A, Saha D, MaulikSG, Bandopadhyay AK. Comparative study of clonidine versus lignocaine for attenuation of haemodynamic responses during laparoscopic hysterectomy. J Basic ClinReprodSci. 2014;3(1):38-43.
23. Gupta K, Lakhanpal M, Gupta PK, Krishan A, Rastogi B, Tiwari V. Premedication with clonidine versus fentanyl for intraoperative hemodynamic stability and recovery outcome during laparoscopic cholecystectomy under general anesthesia. Anesthesia, essays and researches. 2013 Jan;7(1):29.
24. KalraNK, Verma A, Agrawal A, Pandey H. Comparative study of intravenously administered clonidine and magnesium sulphate on hemodynamic responses during laparoscopic cholecystectomy. J AnaesthClinPharmacol. 2011;27(3):344-8.
25. Tripathi DC, Shah KS, Dubey SR, Doshi SM, Raval PV. Hemodynamic stress response during Laparoscopic cholecystectomy: Effect of two different doses of intravenous clonidine premedication. J AnaesthClinPharmacol. 2011;27(4):475-80.
26. Baratz RA, karisJH. Blood gas studies during laparoscopic under general anesthesia. Anesthesiology. 1969;30(4):463-64.
27. Hazra R, Manjunatha SM, ManuarMDB, Basu R, Chakarborty S. Comparison of the effects of intravenously administered dexmedetomidine with clonidine on hemodynamic responses during laparoscopic cholecystectomy. Anaesth Pain and Intensive Care. 2014;18(1):25-30.
28. Lawrence CJ, De Lange S. Effect of a single pre-operative dexmedetomidine dose on Isoflurane requirements and perioperative haemodynamic stability. Anaesthesia 1997;52(8):736-44.
29. Swaika S, Parta N, Chattopadhyay S, Bisui B, Banarjee SS, Chattarjee S. A comparative study of efficacy of intravenous paracetamol and dexmedetomidine on peri-operative hemodynamics and post-operative analgesia for patients undergoing laparoscopic cholecystectomy. Anesth Essays Res. 2013:7(3):331-335.
30. Ghodki PS, Thombre SK, Sardesai SP, Harnagle KD. Dexmedetomidine as an anesthetic adjuvant in laparoscopic surgery: An observational study using entropy monitoring. Journal of anaesthesiology, clinical pharmacology. 2012 Jul;28(3):334.
31. Tufanogullari B, White PF, Peixoto MP, Kianpour D, Lacour T, Griffin J, Skrivanek G, Macaluso A, Shah M, Provost DA. Dexmedetomidine infusion during laparoscopic bariatric surgery: the effect on recovery outcome variables. Anesthesia & Analgesia. 2008 Jun 1;106(6):1741-8.