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Comparative Study of the Effect of Dexmedetomidine v/s Fentanyl on Intraoperative Hemodynamic Response in Robot Assisted Lower Abdominal Onco-Surgeries in Steep Trendlenburg Position

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Abstract

Introduction: Carbon dioxide insufflation for pneumoperitoneum causes increase plasma levels of catecholamines and vasopressin which leads to hemodynamic disturbances. These effects are exaggerated by the trendelenburg position and long duration of surgery in robot assisted surgeries. This study was designed to evaluate the effect of Dexmedetomidine and fentanyl on hemodynamics in robot assisted surgeries in trendlenberg position. *Methods:* After obtaining Ethical committee clearance and patients consent, randomised comparative study on 40 ASA I and II patients, who were randomly allocated to receive either dexmedetomedine or fentanyl intravenous infusion was done. Patients with ASA III & IV, on β blockers, HR<55 bpmin were excluded. Intraoperative Hemodynamics, recovery and emergence was assessed. Students 't' test was used. *Results:* The study included 40 patients undergoing robotic lower abdominal surgeries requiring steep trendlenberg positions. Dexmedetomedine group of patients showed better intra operative hemodynamics at various time intervals as compared to Fentanyl group of patients.

Keywords: Robot; Trendlenburg position; Dexmedetomedine.

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Introduction

Robotic assisted surgeries are becoming popular due to its several benefits like early recovery, less tissue damage, minimal incision and shorter hospital stay.Anaesthetic management has become complicated in these surgeries due to cardiopulmonary changes occurring during creation of pneumoperitoneum with CO_2 with patients in trendlenberg position and maintenance of immobility of patients throughout the surgery. Pneumoperitoneum is associated with sympathetically mediated adverse haemodynamic effect like elevation of arterial pressure, heart rate, decrease in cardiac output due to pneumoperitoneum and increase of systemic and pulmonary vascular resistances. Peritoneal insufflations also results in ventilatory and respiratory changes and can contribute to stress response. These effects are further exaggerated by the trendlenberg position.

Dexmedetomidine, an alpha 2 selective

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adrenoceptor agonists is known to maintain stable hemodynamics due to its effect on central sympatholytic system. Fentanyl being an opioid analgesic acts via opioid receptors to blunt hemodynamic responses. Opioids are known to cause acute hyperalgesia [1] in the immediate postoperative period and also ileum and urinary retention with prolonged sedation. Recent studies have shown that Dexmedetomedine has an opioid equivalent analgesic actions in laparoscopic surgeries [2,3].

The study was aimed to compare the effect of Dexmedetomedine Vs Fentanyl on hemodynamic response to tracheal intubation, following pneumoperitoneum and intraoperative period in patients undergoing robotic oncology surgeries in trendlenberg position.

Methods

After obtaining approval from hospital ethical committee and informed consent from all the patients, a prospective randomised controlled study was conducted on forty patients aged 18-60 years, with American Society Anaesthesiologists (ASA) status I and II who were undergoing elective robotic oncology surgeries requiring trendelenberg position.

Exclusion criteria were patient with acute and chronic renal failure, compromised cardiovascular function, severe deranged liver function, patients with ASA Grade III and IV, emergency cases, patients on β blocker and patients with HR <55/min.

The study drugs were then prepared as follows: 2 ml (200 µg) of study drug Dexmedetomidine was diluted in 48ml of normal saline to make 50 ml (concentration 4 µg/ml.). 4 ml (200 µg) of study drug fentanyl was diluted in 46 ml normal saline to make 50 ml (conc. 4 µg/ml).

Intra Venous access was secured with a 18 G cannula and infusion of Ringer's lactate was started.

The prepared drug Dexmedetomidine or fentanyl was given as follows:

Group-D (N=20): IV Dexmedetomidine 1 µg/kg/hr was given as loading dose over 10 minutes prior to induction and then continued intraoperatively with Dexmedetomidine of 0.5 µg/kg/hrIV infusion.

Group-F (N=20): IV fentanyl 1 µg/kg/hr was given as a loading dose over 10 minutes prior to induction and then continued intraoperatively with fentanyl of 0.5 µg/kg/hrIV infusion.

Hemodynamic parameters as ECG, HR, RR, SBP, DBP, MAP and SpO_2 were recorded at baseline.

The patient was pre-oxygenated with 100% oxygen for three minutes. Following this, Inj. Glycopyrrolate 0.2 mg IV (as and when required when HR<50/min), Inj. Ondansetron 4 mg I.V and IV Midazolam 1mg were given before induction.

Anaesthesia induced with IV Propofol 1 mg/kg and inhalation agent with vecuronium as a muscle relaxant. Intraoperatively anaesthesia maintained with Inhalational agents, Muscle relaxant infusion and Study drug infusion with Positive Pressure Ventilation.

Intraoperatively parameters like ECG, HR, SBP, DBP, MAP, SpO_2, and $EtCO_2$ were continuously recorded.

The above parameters were then recorded at predetermined time intervals as follows: prior to infusion of study drug, 10 minutes after the study drug, after Inj. of induction drug, after intubation, five minutes after intubation, after pneumoperitoneum, 15 minutes after pneumoperitoneum, 30 minutes after pneumoperitoneum, 45 minutes after pneumoperitoneum, 60 minutes after pneumoperitoneum, every 30 mins thereafter till the release of pneumoperitoneum and five minutes after release of pneumoperitoneum.

Adverse effects like bradycardia, tachycardia, hypotension, hypertension, nausea,vomiting, respiratory depression, if any, noted during operative procedure, were treated as follows:

Bradycardia - (HR<50/min): Inj. Glycopyrrolate 0.2 mg I.V

Tachycardia – (HR >30% above baseline value): Inj. Propofol 20 mg I.V in titrated dose

Hypotension – (SBP<60 mmHg) Inj. Ephedrine 6 mg I.V in titrated dose.

Hypertension – (SBP> 140 mmHg): Inj. Propofol 20 mg I.V in titrated dose and 0.25% bupivacaine 5ml of epidural top up and IV Fentanyl 25 microgram.

Infusion of drug (Dexmedetomidine or fentanyl) was stopped and isoflurane was discontinued 10 minutes before reversal. Residual paralysis was reversed with Inj.Neostigmine 0.05 mg/kg IV, and Inj. Glycopyrrolate 8 µg/kg IV. Patient was extubated once extubation criterias were fullfilled.

Parameters were again recorded at five minutes after extubation.

Results

Demographic profile including age, sex, weight,

ASA physical status, duration of anaesthesia and type of operation were comparable in both groups and not of much statistically significant.

The preoperative baseline haemodynamic parameters like mean HR, SBP, DBP, SpO_2 in Group D and in Group F were not significant between two groups.

At 10 mins after Loading Dose there was 18% fall in HR, 12.5% fall in SBP, 10.5% fall in DBP and 9.5% fall in MAP in Group D as compared to 2% fall in HR, 11.3% fall in SBP, 9.6% in DBP and 10.5% fall in MAP fall in Group F patients.

After intubation there was 21% fall in HR, 13.3% fall in SBP, 9.4% fall in DBP and 9.5% fall in MAP in Group D patients as compared to 2% fall in HR, 7.6% fall in SBP, 3.6% fall in DBP, 6.7% fall in MAP in Group F patients.

After insufflation there was 29.8% fall in HR, 20% fall in SBP, 17.5% fall in DBP and 17% fall in MAP in Group D patients as compared to 12.3% fall in HR, 7.6% fall in SBP, 3.5% increase in DBP and 2% fall in MAP in Group F patients.

Throughout intraoperative period of pneumoperitoneum Group D showed significant fall in HR, SBP, DBP, MAP from baseline and more stable values at all points of time intervals where as it remains similar to baseline values or at sometimes above baseline values in Group Fpatients (Graph 1,2,3).

At extubation there was 24.5% fall in HR, 13.98% fall in SBP, 10.5% fall in DBP and 10.5% fall in MAP in Group D patients as compared to 5.6% fall in HR, 4.6% fall in SBP, 0% variation in DBP and 2% increase in MAP in Group F patients.

Intraoperative hypertension was found in 3 patients (15%) in Group D and 6 patients (30%) in Group F patients and 3 (50%) patients in Group F needed treatment of Hypertension.

Intraoperative Bradycardia was found in 4 (20%) patients in Group D and 2 (50%) patients required intervention.

Intraoperative tachycardia was found in 5 (25%) patients in Group F. 8 patients (40%) of patients were sedated at the end of surgery but arousable to commands with no respiratory depression in group D patients and were shifted to ICU with ET tube in situ.

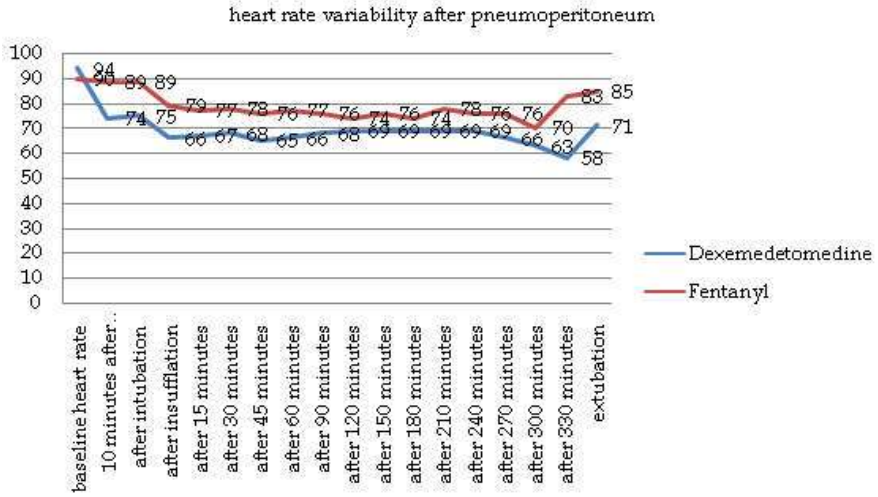
In fentanyl group of patients, 4 (20%) patients were sedated and responding to painful stimuli with no respiratory depression and were shifted to ICU with ET tube in situ. (Table 1).

Table 1:

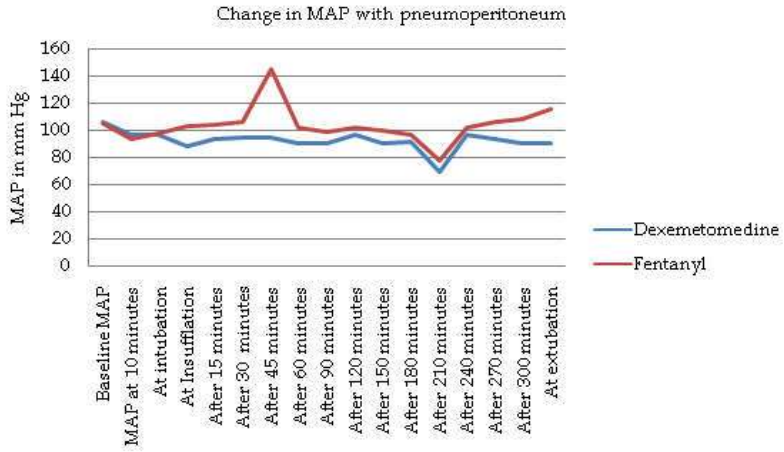
	Dexmedetomedine	Fentanyl
Intraoperative Bradycardia	4 (20%)	0
Treatment	2 (50%)	0
Intraoperative Tachycardia	0	5 (25%)
Treatment		0
Intraoperative Hypertension	3 (15%)	6 (30%)
Treatment	1 (5%)	4 (20%)
Sedation	8 (40%)	6 (30%)
Respiratory Depression	0	0
ECG Abnormality	0	0

Extubation response was smooth in Dexmedetomidine group of patients as compared to Fentanyl group of patients.

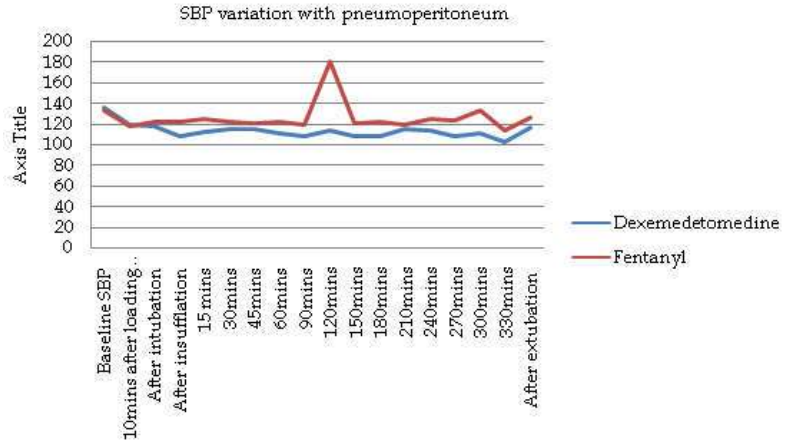
None of our patients in both groups have any respiratory depression. None developed any ECG abnormality.



Graph 1:



Graph 2:



Graph 3:

Discussion

Pneumoperitoneum is known to increase systemic vascular resistance, mean arterial pressures, cardiac filling pressures and cardiac index. CO_2 insufflation results in hypercarbia due to peritoneal absorption of CO_2 which results in increase in HR, BP and increased risk of arrythmias due to sympathetic nervous system stimulation and also decreases myocardial contractility [4,5].

The hemodynamic changes are further exaggerated with the increasing degree of steep trendlenberg position [6].

The opioid free and opioid sparing analgesic techniques are known to reduce the side effects associated with opioids and hence helps in faster recovery, early ambulation, early oral intake [7]. Side effects like PONV, postoperative ileus seen in these kind of surgeries along with postoperative hyperalgesia are known to be aggravated with the use of opioids [1].

Alpha 2 agonists are shown to be effective as sole analgesic agents intraoperatively with better and stable hemodynamic control with sympatholytic, antinociceptive and sedative properties [8, 9]. A variety of pharmacological agents namely opioids, beta blockers, calcium channel blockers, combined alpha and beta blockers, lignocaine, and alpha-2 receptor agonists have been used to maintain stable hemodynamics in the perioperative period. Fentanyl being widely used intraoperatively for control of hemodynamics, is associated with side effects such as respiratory depression and increased incidence of postoperative nausea and vomiting (PONV). No studies have been done to study the effects of Dexmedetomidine and fentanyl on the hemodynamic profile in robotic surgeries requiring steep trendlenberg positions. Hence, this study was done to compare the efficacy of the two study drugs

on the hemodynamic changes intraoperatively in robotic surgeries.

Our study demonstrates that use of Dexmedetomidine for intraoperative infusion helps attenuates stress responses to different noxious stimuli during surgery and helps maintain haemodynamic stability perioperatively.

Our observation shows significantly less increase in HR in Dexmedetomidine group as in comparison with fentanyl group after intubation, after pneumoperitoneum, intraoperative period and after extubation which is in accordance with that of other studies. This is because Dexmedetomidine effectively blunts sympatho adrenal response to intubation and has good sympatholytic activity. Suparto *et al.*, [13] concluded that both Dexmedetomidine at 1 µg/Kg and fentanyl at 1 µg/Kg given intravenously as single bolus dose prior to anaesthesia induction produced lowering of blood pressures and cardiac rates, with significantly lower mean heart rates with Dexmedetomidine i.e., 21% decrease in Dexmedetomidine group vs 2% decrease in fentanyl group.

In our study, there is less fluctuation in SBP, DBP and MAP in Dexmedetomidine group in comparison to fentanyl after intubation, after pneumoperitoneum and after extubation. This implies that Dexmedetomidine had attenuated stress response perioperatively. Similar findings were observed by Patel CR *et al.* [15] and Jayshree P Vaswani *et al.* [10] and also Feld JM *et al.* [11] in which HR and BP decreased.

Intraoperatively throughout hemodynamics was more stable in Dexmedetomidine (0.5 µg/kg infusion) group of patients when compared to Fentanyl (0.5 µg/kg infusion) group of patients which is consistent with that of Sharif SM *et al.*, [16] who observed that both Dexmedetomidine (1 µg/kg) and fentanyl (2 µg/kg), when used as premedicant before induction attenuated the haemodynamic response to pneumoperitoneum during laparoscopic surgeries.

Hall JE *et al.*, [17] in their study concluded that small doses of Dexmedetomidine led to significant sedation which could be reversed by the help of verbal or physical stimuli and it resolved completely after two hour of termination of infusion. In our study, no stastically significant sedation was seen in any patient though eight patients had sedation score ≤ 3 in Group D.

Group D patients had less extubation response as compared to Group F patients which is similar to Goyal S *et al.* [18] study.

Limitation

We have done a small study of 40 patients and could not analyse the post op analgesic requirement and total amount of the study drug consumed, cost effectiveness of the study drugs and also requirement of inhalational agents in the two study groups.

Conclusion

To conclude Dexmedetomedine causes greater attenuation of hemodynamic response to tracheal intubation, following pneumoperitoneum and perioperatively with stable hemodynamics as compared to Fentanyl in surgeries requiring pneumoperitoneum in steep trendlenberg position. Dexmedetomedine patients had better sedation score and easy arousability.

Hence, intravenous premedication with Dexmedetomedine in dose of 1µg/kg as loading dose over 10 minutes prior to induction in robotic assisted surgeries requiring steep trendlenberg position followed by 0.5 µg/kg infusion till surgery is over, may be recommended for better haemodynamic stability during perioperative period.

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