

COMPARATIVE STUDY OF DEXMEDETOMIDINE VS FENTANYL ON INTRAOPERATIVE HEMODYNAMIC CHANGES AND RECOVERY IN LAPAROSCOPIC GYNAECONCOLOGY SURGERIES IN STEEP TRENDLENBURG POSITION

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Abstract

Introduction: Pneumoperitoneum from Carbon di oxide insufflation will result in increase plasma levels of catecholamines and vasopressin that leads to hemodynamic disturbances. These effects are exaggerated by the steep trendelenburg position. This study was designed to evaluate the effect of Dexmedetomidine and fentanyl on hemodynamics in laparoscopic gynaecology surgeries which requires steep trendelenburg position.

Methods: After obtaining Ethical committee clearance and patients consent, prospective randomised comparative study was done on 60 ASA I and II patients who were randomly assigned to receive either dexmedetomidine or fentanyl infusion. Patients with ASA III & IV, on β blockers were excluded. Intraoperative hemodynamics, recovery and emergence was assessed. Students 't' test was used

Results: The study included 60 patients undergoing laparoscopic gynaecology oncology surgeries requiring steep trendelenburg positions. Dexmedetomidine group of patients had better intra operative hemodynamics throughout and postoperative recovery when compared with Fentanyl group of patients.

Conclusion: Using Dexmedetomidine infusion in patients will have stable hemodynamics and postoperative recovery also smooth as compared to fentanyl.

Keywords: Steep trendelenburg position, dexmedetomidine

Introduction

Minimally invasive surgeries have become popular due to the benefits like early recovery, early ambulation, minimal tissue damage, minimal incision and reduced duration of hospital stay. Management of anaesthesia is complicated in these minimally invasive surgeries due to cardiopulmonary changes that occurs with Carbon di oxide pneumoperitoneum. All these effects are exaggerated in patients with steep trendelenburg position. CO₂ Pneumoperitoneum is known to cause 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 insufflation also results in ventilatory and respiratory changes which can also contribute to the stress response. All these effects are further exaggerated by the steep trendelenburg position.

Dexmedetomidine, which is an alpha 2 selective adrenoceptor agonists due to its effect on central sympatholytic system is known to maintain stable hemodynamics. Fentanyl 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 postoperative ileus and urinary retention with prolonged sedation. Recent studies have shown that Dexmedetomidine has an opioid equivalent analgesic actions in laparoscopic surgeries^[2, 3].

The study aimed to compare the effect of Dexmedetomidine Vs Fentanyl on hemodynamic response intraoperatively following pneumoperitoneum in laparoscopic gynaecology surgeries in steep trendelenburg position.

Methods

Once hospital ethical committee approval was taken and informed consent from all the patients, we conducted a prospective randomised controlled study on sixty patients aged 18-60 years, with American Society Anaesthesiologists (ASA) status I and II undergoing elective laparoscopic gynaecology surgeries in steep trendelenburg position.

Patients 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 were excluded from the study.

Preparation of the study drug was done accordingly. For dexmedetomidine group of patients 2 ml (200 μ g) of study drug Dexmedetomidine was diluted in 48ml of normal saline to make 50 ml (concentration 4 μ g/ml.) and for fentanyl group of patients 4 ml (200 μ g) of study drug fentanyl was diluted in 46 ml normal saline to make 50 ml (concentration 4 μ g/ml).

18 G IV cannula was used to secure intravenous access and infusion of Ringer's lactate was started.

Method of giving the drug infusion-The prepared drug was given as follows: Group-D (N=20): IV Dexmedetomidine 1 μ g/kg/hr was given as loading dose over 10 minutes prior to induction and then continued intraoperatively with Dexmedetomidine of 0.5 μ g/kg/hr IV infusion.

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

Hemodynamic parameters as ECG, HR, RR, SBP, DBP, MAP and SpO₂ were recorded at baseline.

Pre-oxygenation with 100% oxygen for three minutes was done for all patients before induction. Following this Inj. Glycopyrrolate 0.2 mg IV, Inj. Ondansetron 4 mg IV and IV Midazolam 1mg were given before induction.

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

Intraoperatively parameters like ECG, HR, SBP, DBP, MAP, SpO₂ and EtCO₂ were continuously recorded.

The above parameters were then recorded at time intervals as follows: prior to infusion of study drug, 10 minutes after the study drug, immediately 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 study drugs (Dexmedetomidine or fentanyl) were stopped towards the end of the procedure. Neuromuscular paralysis was reversed with Inj. Neostigmine 0.05 mg/kg IV, and Inj. Glycopyrrolate 8 μ g/kg IV once reversal patient had efforts. Based on extubation criteria it was decided if patients are to be shifted on endotracheal tube to ICU and extubated later or if criteria are met extubate on table.

Results

Demographic profile including age, sex, weight, ASA physical status, duration of anaesthesia and type of operation were comparable in both groups and were not significant statistically.

The baseline haemodynamic parameters of HR, SBP, DBP, SPO₂ were not significant statistically between two groups. At 10 mins after Loading Dose there was 17% fall in HR, 12% fall in SBP, 11% fall in DBP and 9.5% fall in MAP in Group D as compared to 1% fall in HR, 10.3% fall in SBP, 9% in DBP and 10% fall in MAP fall in Group F patients.

After intubation there was 19% fall in HR, 12% fall in SBP, 8.5% fall in DBP and 9% fall in MAP in Group D patients as compared to 1% fall in HR, 8% fall in SBP, 3.8% fall in DBP, 7.2% fall in MAP in Group F patients.

After insufflation there was 28.9% fall in HR, 19% fall in SBP, 18% fall in DBP and 16% fall in MAP in Group D patients as compared to 12.3% fall in HR, 7.8% fall in SBP, 4.5% increase in DBP and 2% fall in MAP in Group F patients.

Intraoperatively Group D patients showed significant fall in HR, SBP, DBP, MAP from baseline but had more stable values at most of the time intervals throughout where as hemodynamic parameters remains similar to baseline values or at sometimes above baseline values in Group F patients.

At extubation there was 24% fall in HR, 14% fall in SBP, 11% fall in DBP and 10% fall in MAP in Group D patients as compared to 5.6% fall in HR, 5% fall in SBP, 0% variation in DBP and 1% increase in MAP in Group F patients.

Intraoperative hypertension was found in 2 patients (6.6%) in Group D and 6 patients (20%) in Group F patients and 4 (66%) patients in Group F needed treatment of Hypertension.

Intraoperative Bradycardia was found in 4 (13.3%) patients in Group D and 2 (50%) patients required intervention, none of the patients in group F had bradycardia.

Intraoperative tachycardia was found in 7 (23%) patients in Group F.

8 patients (26.6%) 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, 15(50%) patients were sedated and responding to painful stimuli and were shifted to ICU with ET tube in situ.

Extubation response was smooth in Dexmedetomidine group of patients as compared to Fentanyl group of patients. All patients in dexmedetomidine group recovered early and were extubated early as compared with fentanyl group of patients. 15 (50%) patients in fentanyl group had delayed recovery and were extubated next day morning.

8 (26.6%) patients in fentanyl group had respiratory depression and were extubated next day.

None developed any ECG abnormality.

Table 1: Adverse Effects

Adverse effects	Dexmedetomidine	Fentanyl
Intraoperative bradycardia	4(13.3%)	0
Treatment	2(50%)	0
Intraoperative tachycardia	0	7(23%)
Treatment	0	2(50%)
Intraoperative Hypertension	2(6.6%)	6(20%)
Treatment	0	4(66%)
Sedation	8(26.6%)	15(50%)
Respiratory depression	0	8(26.6%)

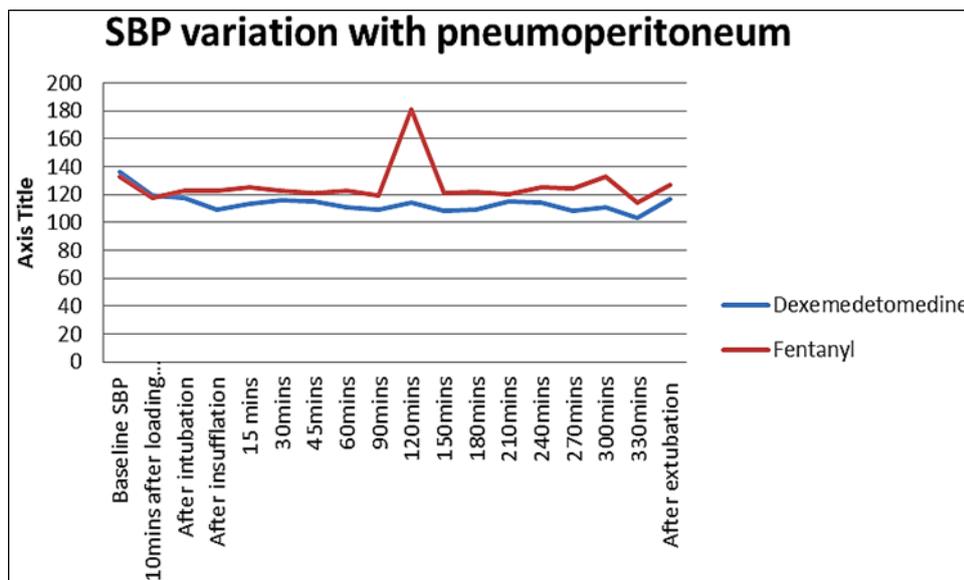


Fig 1: Systolic blood Pressure

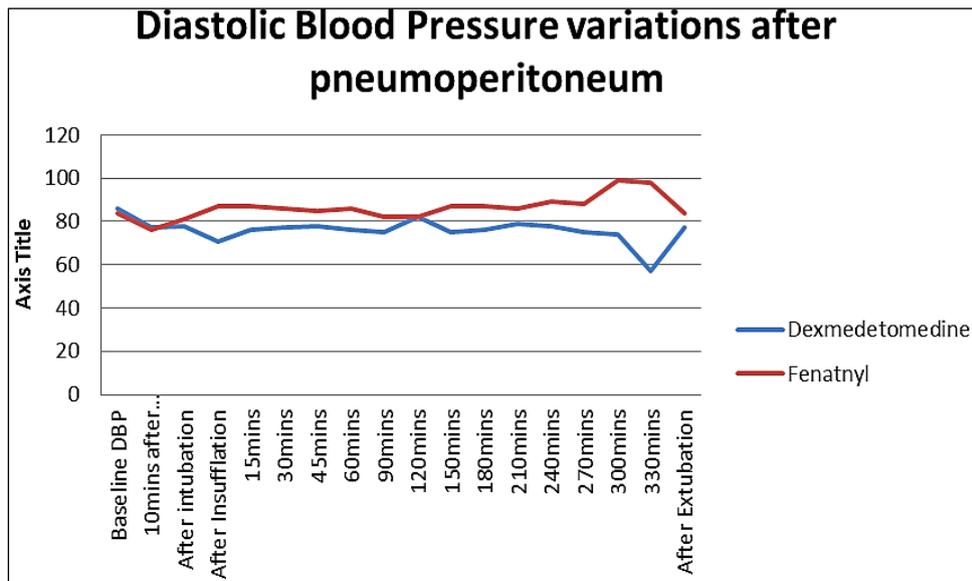


Fig 2: Diastolic blood Pressure

Discussion

Pneumoperitoneum created during laparoscopic surgeries is known to increase systemic vascular resistance, mean arterial pressures, cardiac filling pressures and cardiac index. CO₂ insufflation results in hypercarbia due to peritoneal absorption of CO₂ which results in increase in HR, BP and increased risk of arrhythmia due to sympathetic nervous system stimulation and also decreases myocardial contractility^[4, 5].

Steep trendelenburg position will further increase these adverse cardiopulmonary effects caused by CO₂ insufflation during laparoscopic surgeries^[6].

The opioid free and opioid sparing analgesic techniques are becoming popular recently because of their advantage of having less side effects as compared to those associated with opioids and also helps in faster recovery, early ambulation, early oral intake and early initiation of chemotherapy^[7]. Opioids side effects like PONV, postoperative ileus along with postoperative hyperalgesia are known to be aggravated with the use of opioids^[1].

Alpha 2 agonists are emerging as sole analgesic agents for use intraoperatively with better and stable hemodynamic control because of its sympatholytic, antinociceptive and sedative properties^[8, 9]. Various combination of pharmacological agents like opioids, beta blockers, calcium channel blockers, combined alpha and beta blockers, lignocaine, and alpha-2 receptor agonists have been tried to maintain stable hemodynamics perioperatively. Fentanyl is being widely used for perioperative control of hemodynamics but side effects such as respiratory depression and increased incidence of postoperative nausea and vomiting (PONV) and opioid hyperalgesia are known.

Limited studies have been done comparing the effects of Dexmedetomidine and fentanyl on the hemodynamic profile in laparoscopic gynaecology surgeries which requires steep trendelenburg position and for longer duration. So this study was conducted to compare the efficacy of the two study drugs on the hemodynamic changes intraoperatively and also to study the postoperative recovery status.

Our study demonstrates that use of Dexmedetomidine intraoperatively as infusion helps to attenuate stress responses to various kind of stimuli during surgery and also helps in maintaining haemodynamic stability perioperatively with good postoperative recovery.

Our study demonstrates significantly less increase in HR in Dexmedetomidine group as compared with fentanyl group after pneumoperitoneum, throughout intraoperative period and also after extubation. Because Dexmedetomidine is known to effectively blunt 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.

Less fluctuation in SBP, DBP and MAP in Dexmedetomidine group as compared to fentanyl group of patients after pneumoperitoneum and after extubation were noted in our study. 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.

Intraoperative 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 premedication 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. Sedation noted in our study was not statistically significant though eight patients had sedation score ≤ 3 in Group D.

15 patients in Fentanyl group had sedation and delayed recovery among which 8 of them had respiratory depression and all of them were extubated after 12-14 hours. This shows that fentanyl group of patients had respiratory depression and delayed recovery as compared to dexmedetomidine group.

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

Limitation

Our study should have had a parameter to analyse post-operative opioid consumption 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.

Our study should have had postoperative analgesic scoring.

Conclusion

To conclude Dexmedetomidine causes greater attenuation of hemodynamic response following pneumoperitoneum and throughout intraoperatively with stable hemodynamics as compared to Fentanyl in these Gynaecology surgeries which requires pneumoperitoneum in steep trendelenburg position for prolonged period. Dexmedetomidine patients had better sedation score and easy arousability.

Postoperative recovery was better and smooth in Dexmedetomidine group of patients where as fentanyl group of patients had respiratory depression and delayed recovery which are the known complications with Opioids.

Hence, intravenous premedication with Dexmedetomidine in dose of 1 µg/kg as loading dose over 10 minutes prior to induction in laparoscopic gynaecology surgeries requiring steep trendelenburg position followed by 0.5 µg/kg infusion till surgery is over, may be recommended for better haemodynamic stability during perioperative period and also for smooth recovery postoperatively.

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