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COMPARATIVE STUDY OF DEXMEDETOMIDINE AND FENTANYL ON HAEMODYNAMIC RESPONSES DURING LARYNGOSCOPY AND PNEUMOPERITONEUM IN LAPAROSCOPIC CHOLECYSTECTOMY

Anaesthesiology

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ABSTRACT

INTRODUCTION: Laparoscopic surgeries form an essence of today's surgical practice because of its magnification, dexterity, less cosmetic scar, less postoperative pain, and decreased hospital stay along with less morbidity and mortality. Laparoscopic cholecystectomy has become the gold standard for gall bladder diseases. It is termed as patient friendly surgery because of less postoperative pain, shorter hospitalization and faster functional recovery along with other advantages of laparoscopic procedures.

AIMS AND OBJECTIVES: Aims and objectives of this study are comparison of dexmedetomidine and fentanyl in attenuating hemodynamic changes that occur due to laryngoscopy and endotracheal intubation. Comparison of dexmedetomidine and fentanyl during creating pneumoperitoneum in laparoscopic cholecystectomy. We will observe the change in systolic blood pressure as well as diastolic and mean blood pressure and pulse rate on both occasions. Adverse reaction of these two drugs.

MATERIALS AND METHOD: This prospective, randomized, single blind placebo controlled study was done after approval of the Ethics cum Screening Committee of KPC Medical College and Hospital, Jadavpur, Kolkata. The study was carried out in the NEW OT COMPLEX in the KPC Medical College and Hospital during the period from March 2016- Oct 2017.

A total of 60 patients of ASA physical status I and II were selected for this study. Standard dropout rates were taken into consideration. They were divided into two groups, Group F (n=30) in which patients received fentanyl and Group D (n=30) in which patients received dexmedetomidine.

RESULT AND ANALYSIS: Our study showed that the t-test showed that there was no significant difference in mean of the patients of the two groups ($p>0.05$). Also 2χ test showed that there was no significant difference in gender of the patients of the two groups ($p=0.55$). All the patients in both the groups were with ASA Grade-I & II. Thus the patients of the two groups were matched for all demographic parameters. t-test showed that the mean heart rate of the patients of Group-F was significantly higher than that of Group-D for all the time intervals except at 15 minutes before induction and HR Just before induction ($p<0.0001$).

CONCLUSION: Dexmedetomidine is also better in attenuating the hemodynamic surge during pneumoperitoneum. Incidence of adverse effects like Post operative nausea and vomiting is more in Fentanyl group than dexmedetomidine group.

KEYWORDS

Dexmedetomidine, Fentanyl, Laryngoscopy and Pneumoperitoneum

INTRODUCTION

Laparoscopic surgeries form an essence of today's surgical practice because of its magnification, dexterity, less cosmetic scar, less postoperative pain, and decreased hospital stay along with less morbidity and mortality [1].

Laparoscopic cholecystectomy has become the gold standard for gall bladder diseases. It is termed as patient friendly surgery because of less postoperative pain, shorter hospitalization and faster functional recovery along with other advantages of laparoscopic procedures [2].

Laryngoscopy and endotracheal intubation, which are a basic and integral part of general anesthesia (GA), are associated with reflex sympathetic stimulation, manifested by tachycardia and hypertension. This is known as pressor response and has the potential to cause major complications such as myocardial ischemia, ventricular arrhythmia, left ventricular failure and cerebral hemorrhage in high risk patients.

The pressor response, which is part of a huge spectrum of stress response, results from the increase in sympathetic and sympatho-adrenal activity, as evidenced by increased plasma Catecholamines concentrations in patients undergoing surgery under general anaesthesia.

These haemodynamic changes arise as a form of sympathoadrenal reflex and due to release of norepinephrine and, to a lesser extent, of epinephrine. So, effective attenuation of the sympathoadrenal stress response is an important goal in anaesthesiology. Various pharmacologic and nonpharmacologic method have been tried to limit the pressor response following the insertion of endotracheal tube.

These agents such as opioid analgesics, benzodiazepines, beta blockers, calcium channel blockers, and vasodilators have been used with variable success [3].

In addition, in laparoscopic surgery CO2 is routinely used to create pneumoperitoneum, which causes increased plasma level of Catecholamines and vasopressin. Elevation of intra - abdominal pressure with raised diaphragm causes various adverse effects on the cardiovascular system such as decreased cardiac output, elevated arterial pressure and increased systemic and pulmonary vascular resistance leading to hypertension and tachycardia. Hence, a drug, which can blunt hemodynamic responses to laryngoscopy, intubation and pneumoperitoneum without having any adverse effects like respiratory depression and postoperative nausea and vomiting (PONV) was required for the purpose.

Dexmedetomidine is an alpha-2-adrenergic agonist, which is the pharmacologically active dextro-isomer of medetomidine. It has properties of analgesia, sympatholysis and titrating sedation without major respiratory depression [4]. .

Fentanyl (a μ-opioid receptor agonist) possesses a potent analgesic property with a rapid and a short duration of action. Fentanyl has been used for attenuating the haemodynamic pressor response during laryngoscopy and endotracheal intubation and for attenuating the haemodynamic responses during laparoscopy [5].

In this placebo-controlled, randomized, single-blind, unicentric, prospective study an attempt has been made to observe, assess and compare the efficacy of these two drugs.

Aims and objectives of this study are

1. Comparison of dexmedetomidine and fentanyl in attenuating hemodynamic changes that occur due to laryngoscopy and endotracheal intubation.
2. Comparison of dexmedetomidine and fentanyl during creating pneumoperitoneum in laparoscopic cholecystectomy.

3. We was observed the change in systolic blood pressure as well as diastolic and mean blood pressure and pulse rate on both occasions.
4. Adverse reaction of these two drugs.

MATERIALS AND METHOD

This prospective, randomized, single blind placebo controlled study was done after approval of the Ethics cum Screening Committee of KPC Medical College and Hospital, Jadavpur, Kolkata. The study was carried out in the NEW OT COMPLEX in the KPC Medical College and Hospital during the period from March 2016- Oct 2017.

DEFINITION OF POPULATION

Randomly selected 60 patients in between the age of 18-45 yrs, of either sex, belonging to ASA(American Society of Anaesthesiologists) physical status I or II, undergoing laparoscopic cholecystectomy. They were devided randomly into two groups- Group D and Group F .

INCLUSION CRITERIA-

1. Willing patients
2. Age 18 -45 year of either sex.
3. ASA grade I & II
4. Only one attempt of intubation was accepted in the study.
5. Mallampati classification I & II

EXCLUSION CRITERIA-

1. Unwilling patients,
2. ASA III & above,
3. Patients of age more than 45 year &less than 18 yr,
4. Patient with co-morbidities,
5. The patients with baseline heart rate < 60 beats/ mint and . Baseline blood pressure <90/50 mm of Hg,
6. Mallampati classification III & IV.

SAMPLE SIZE

A total of 60 patients of ASA physical status I and II were selected for this study. Standard dropout rates were taken into consideration. They were divided into two groups, Group F (n=30) in which patients received fentanyl and Group D (n=30) in which patients received dexmedetomidine.

RESULT AND ANALYSIS

Our study showed that the t-test showed that there was no significant difference in mean of the patients of the two groups ($p>0.05$). Also X^2 test showed that there was no significant difference in gender of the patients of the two groups ($p=0.55$). All the patients in both the groups were with ASA Grade-I & II. Thus the patients of the two groups were matched for all demographic parameters. t-test showed that the mean heart rate of the patients of Group-F was significantly higher than that of Group-D for all the time intervals except at 15 minutes before induction and HR Just before induction ($p<0.0001$).

We found in t-test showed that the mean SBP of the patients of Group-F was significantly higher than that of Group-D for all the time intervals except at 15 minutes before induction and HR Just before induction ($p<0.0001$). t-test showed that the mean DBP of the patients of Group-F was significantly higher than that of Group-D for all the time intervals except at 15 minutes before induction and HR Just before induction ($p<0.0001$). t-test showed that the mean MAP of the patients of Group-F was significantly higher than that of Group-D for all the time intervals except at 15 minutes before induction and HR Just before induction ($p<0.0001$).

DISCUSSION

In this double blinded, controlled study we tried to evaluate the role of fentanyl and dexmedetomidine in attenuating pressor response during laryngoscopy and pneumoperitoneum patients posted for laparoscopic cholecystectomy under general anaesthesia.

In Table 1 we can see that there is no significant difference in mean age of the patients of both the group D &group F. Also there is no significant difference in the sex of the both the groups, in both the groups majority of the subjects were female and mean age of around 35 years

The haemodynamic pressor response to laryngoscopy and intubation due to sympathetic stimulation first described by Reid and Brace. [6] Excessive sympathetic stimulation particularly in patients with haemodynamic compromise, elderly or high risk patients can lead to catastrophic events like cerebral haemorrhage, myocardial ischemia and thereby increases the morbidity or mortality of the patients.

Again laparoscopic surgery also requires creation of pneumoperitoneum (PNP), which is commonly done with insufflation with CO_2. Elevated intra abdominuteal pressure after creation of PNP leads to rise in plasma level of nor-epinephrine, epinephrine, and renin activity. Activation of Renin-angiotensin-aldosterone-system leads to various hemodynamic alterations such as decreased cardiac output, elevated arterial pressure and increased systemic/pulmonary vascular resistance. Pneumoperitoneum during laparoscopic surgery leads to significant hemodynamic changes. These physiological changes are of special concern to anaesthesiologists for safe and efficient management of the patient undergoing laparoscopic cholecystectomy. So to compare the efficacy and others we have taken fentanyl and dexmedetomidine.

Dexmedetomidine, being a highly selective α2 agonist is sympatholytic and also has haemodynamic stabilization property. It leads to dose-dependent decrease in heart rate and blood pressure. Previous studies have shown that dexmedetomidine controls stress response to intubation by decreasing central sympathetic outflow, hence decreasing serum epinephrine and norepinephrine levels. It stimulates receptors in the medullary vasomotor center, reducing norepinephrine turnover and controls central sympathetic outflow, resulting in alterations in sympathetic function, hence suppressing the haemodynamic response to intubation, extubation without any side effects like respiratory depression and Post operating Nausea and Vomiting (PONV). It leads to a dose dependent decrease of arterial BP and HR due to decrease in serum norepinephrine concentrations. Also, this is due to decrease in central stimulation of parasympathetic outflow and inhibition of sympathetic outflow from the brainstem- the locus coeruleus.

Dexmedetomidine has shown blunting of cardiovascular response to intubation in many studies of patients undergoing general surgery. These findings are consistent with our study results in table 1,2,3 consecutively which showed a significant decrease in change in HR, SBP and DBP.[7]

Intravenous use of dexmedetomidine in the perioperative period had been found to decrease serum catecholaminutee levels by 90%,[8] to attenuate the haemodynamic response to laryngoscopy, tracheal intubation, pneumoperitoneum and extubation, to provide sedation without respiratory depression.

However, we observed attenuation of hemodynamic responses with both the drugs but a near stable hemodynamic with dexmedetomidine makes it a more favorable drug. We observed a comparable difference in between both the groups on monitoring the mean heart rate and mean arterial pressure before premedication. After administering the patients with either dexmedetomidine or fentanyl as per the study protocol, a significant difference in mean arterial pressure and heart rate was observed during laryngoscope and pneumoperitoneum.

Here in this study we have administered injection dexmedetomidine 1 mcg/kg diluted in 10 ml saline and Injection fentanyl 2 mcg/kg diluted in 10 ml saline intravenously over 10 minutes before laryngoscope and intubation and seen that after laryngoscope at all the times i.e. at 30 seconds, 90 seconds , 3 minute and 5 minute there is a significant difference in HR, SBP, DBP & MAP noticed in group D and group F as noted in table 2, 3 and 4 respectively.

These results were similar to Vaibhav jain et al [9], who found that an intravenous infusion of dexmedetomidine at 1 µg/kg adminuteistered 10 minute before laryngoscopyand endotracheal intubation can be recommended over fentanyl at 2 µg/kg to attenuate the sympathetic response to laryngoscopy and endotracheal intubation.

Our study is also similar to Ghodki et al [10]who used dexmedetomidine 1 µg/kg intravenously over 15 minute before induction followed by maintenance infusion of 0.2 µg/kg/h and observed favorable vasopressor response during laryngoscopy with minimal change in BP with pneumoperitoneum.

Here in this study we can see that there is a signicant difference in HR after laryngoscopy at 30 sec, 90 sec, 3 min as well as 5 min readings.

Group D is showing a comparable less surge in HR than group F during that above mentioned times.

Similarly SBP, DBP & MAP shows a signicant difference in those mentioned periods.

In our study we had not found any significant side effects like bradycardia , hypotension in both the groups except nausea and vomiting which is more in Group F peoples than group D .

Table 6 shows that there is no incidence of bradycardia and hypotension in our group. but incidence of nausea and vomiting is more common and statistically significant in group F than group D.

CONCLUSION

From this study we have concluded that

1. Both the drug Fentanyl & Dexmedetomidine are effective in attenuating the hemodynamic adverse effect due to laryngoscopy , intubation and pneumoperitoneum.
2. Dexmedetomidine is better than fentanyl in attenuating the pressor response surge due to laryngoscopy and intubation.
3. Dexmedetomidine is also better in attenuating the hemodynamic surge during pneumoperitoneum.
4. Incidence of adverse effects like Post operative nausea and vomiting is more in Fentanyl group than dexmedetomidine group.

Table: Comparison of demographic parameters and Adverse Effect of the patients of the two groups

		Group-F (mean± s.d.) (n=30)	Group-D (mean± s.d.) (n=30)	Test Statistic (t_{58})	p-value
Demographic Parameters	**Age (in years)**	34.03±6.03	34.46±5.48	0.29	0.77
	Gender (Male: Female)	9:21	7:23	=1.62	0.55
Adverse Effect	**Hypotension**	0 (0.0%)	0 (0.0%)	0.01	0.99 NS
	Bradycardia	0 (0.0%)	0(0.0%)	0.01	0.99 NS
	Nausea	8(26.7%)	3(10.0%)	3.05	<0.001 S

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