Original Research Article

Attenuation of Hemodynamic Response of Intubation and of Pneumoperitoneum during Laparoscopic Cholecystectomy: Comparison between Clonidine and Lignocaine

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Abstract

Background: Laparoscopic cholecystectomy is associated with hemodynamic stress responses both during endotracheal intubation and due to creation of pneumoperitoneum. This stress response is of great concern in hypertensive and geriatric population.

Aim: Comparison between Clonidine and Lignocaine in terms of attenuation of hemodynamic response occurring due to Intubation and due to creation of Pneumoperitoneum during Laparoscopic Cholecystectomy.

Subjects and Methods: This prospective, randomized, double blinded controlled study was conducted on eighty subjects of ASA Grade I and II undergoing elective laparoscopic cholecystectomy. Patients were allocated into two groups, Group C receiving clonidine and Group L receiving lignocaine. Baseline clinical parameters were recorded. All patients received clonidine or lignocaine as a bolus before induction as well as continuous intravenous infusion throughout the surgical procedure. The dose of clonidine given was 2.25 µg/kg bolus and 1.2 µg/kg/hr infusion while that of lignocaine was 1.5 mg/kg bolus and 0.8 mg/kg/hr infusion. The patients were mechanically ventilated to keep EtCO2 between 35 and 40 mm Hg. Heart rate, Systolic blood pressure and diastolic blood pressure were recorded before induction and at 1 min, 3 min, 10 min, 30 min, 60 min and 90 min after intubation. Any adverse effect like hypotension, bradycardia, sedation or shivering were noted and compared.

Results: In comparison to Lignocaine group; attenuation of heart rate, Systolic blood pressure(SBP) and diastolic blood pressure (DBP) were significantly more in Clonidine group ($p<0.05$). There was no significant difference in sedation score between the two groups.

Conclusion: Clonidine was found to be more effective than lignocaine in attenuating the hemodynamic response occurring both due to laryngoscopy and due to creation of pneumoperitoneum in laparoscopic cholecystectomy.

Keywords: Hemodynamic responses, Clonidine, lignocaine, laparoscopic cholecystectomy.

Introduction

Laparoscopic cholecystectomy may be associated with certain hemodynamic changes due to reflex sympathetic discharge. These effects can be minimized by use of pharmacological agents. Creation of pneumoperitoneum as well as patient positioning causes several respiratory and haemodynamic consequenses. Pneumoperitoneum causes rise in intra-abdominal pressure (IAP) and an increase in Systemic Vascular Resistance (SVR) but causes a decrease in Cardiac Output (CO).

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Increase in SVR exceeds decrease in CO and thus Mean Arterial Pressure (MAP) increases overall. As the pressure is transmitted across the diaphragm to the heart, intracardiac filling pressures may be elevated despite decrease in the intracardiac blood volume. Also there might be increase in pulmonary vascular resistance (PVR) and decrease in cardiac output to the lungs. If the patient is placed in extreme Trendelenburg position, the intracranial and intraocular pressures may rise due to decrease in venous return from the head. The reverse Trendelendburg position reduces venous return from the lower half of body, and may lead to a fall in cardiac output and arterial pressure. Insertion of laparoscopic ports as well as the insufflation of abdomen can cause arrhythmias or asystole. Stretching of the peritoneum can cause a profound increase in vagal tone.[1-5]

Lignocaine, a local anesthetic, acts by blocking and inhibiting nerve conduction and thus reduces neural response to pain. It causes depression of conduction in A-delta and C fibers.[6-9]

Alpha-2 adrenoreceptor agonist like clonidine have sympatholytic, sedative, analgesic and cardiovascular stabilizing effects and cause reduced anaesthetic requirements. Clonidine has been shown to have beneficial effects on hemodynamic stress response during laryngoscopy and endotracheal intubation and also reduces bleeding. It reduces the incidence of perioperative myocardial ischemia in patients and decreases requirement of anaesthetics like propofol during surgery. [10-16]

The present study was conducted, to compare the effect of lignocaine and clonidine on hemodynamic changes in different phases of laparoscopic cholecystectomy.

Material and Method

This prospective, randomized, double blind study was conducted on the patients in the age group of 20-55 years and of ASA Grade I or II undergoing elective laparoscopic cholecystectomy. Eighty Patients were divided into two groups using a computer generated random number table into Group C and L.

Group C (n = 40) received inj. Clonidine in bolus and infusion

Group L (n = 40) received inj. Lignocaine in bolus and infusion.

Patients excluded from the study were those of ASA grade ≥ III, pregnant females, those with BMI ≥ 35 kg/m2 and <18.5 kg/m^2, history of seizures, any medical illness like hypertension, diabetes etc and patients with reported adverse reactions in the past to any of the study drugs. Those patients who were predicted to have difficult intubation on airway assessment were also excluded from the study.

Methodology

Patients were taken in OT and vital parameters were attached including Non invasive arterial blood pressure, ECG and pulse oximeter and RL was connected to intravenous line. For Group C patients, inj. clonidine 750 µg (5 ml) was diluted with 20 ml distilled water in a 50 ml syringe to make final concentration of 30 µg/ml. For Group L patients, 25 ml preservative free 2% lignocaine hydrochloride was taken in a 50 ml syringe (concentration 20mg/ml). Both the drugs were diluted to a fixed volume of 25 ml. The anaesthetist being blinded to which group the patient belonged, started the infusion. All the patients received 0.075 ml/kg of solutions as a bolus, given over a period of 15 minutes before induction. Same solution was administered throughout the surgical procedure as continuous intravenous infusion at a rate of 0.04 ml/kg/hour. The dose of clonidine was 2.25 µg/kg bolus and 1.2 µg/kg/hr infusion while that of lignocaine was 1.5 mg/kg bolus and 0.8 mg/kg/hr infusion. After preoxygenation for 3 minutes, anaesthesia was induced with inj. Propofol 1.5 mg/kg and inj fentanyl 1 µg/kg i.v. Endotracheal intubation was done under muscle relaxant atracurium 0.5 mg/kg. Anaesthesia was maintained by oxygen and nitrous oxide (50%+50%), sevoflurane and maintainence dose of atracurium 0.1 mg/kg. Signs of inadequate analgesia, defined as an increase of heart rate and MAP of more than 20% of baseline, were given a bolus dose of fentanyl 0.5 µg/kg. The patients were mechanically ventilated to keep EtCO2 between 35 and 40 mm Hg. All surgical procedures were one to one and half hour long. Readings were taken during laryngoscopy and tracheal intubation and then at 1 min, 3 mins, 10 mins, 30 mins, 60 mins, and 90 mins, following tracheal intubation. At the end of the surgical procedure, neuromuscular blockade was reversed by an appropriate dose of neostigmine and glycopyrrolate. In the PACU, heart rate, SpO2**,** Systolic blood pressure (SBP)**,** Diastolic blood pressure (DBP) were monitored for 24 hours. Postoperative sedation was assessed by Ramsay Sedation Score. Data was analyzed using SPSS version 16. Vitals were compared using Student's't' test. *P* value < 0.05 was considered as statistically significant and > 0.05 as statistically non statistically.

Results

There was no significant difference in demographic profile of patients.(Table 1) Also the difference in the pre operative heart rate and blood pressure between the 2 groups were non significant(p>0.05). On comparing the heart rate between the two groups at 1^{st}, 3^{rd} and 10^{th} minute after intubation, significant difference was seen between the clonidine and lignocaine group(p<0.05). The heart rate was on the lower side in the clonidine group than in the lignocaine group. At rest of the observation periods, i.e. at 30^{th},60^{th} and 90^{th} minute after intubation, the heart rate was comparable in both the groups (p>0.05).The same pattern was seen in the systolic and diastolic blood pressure.

No difference was seen in the sedation scores between the two groups.

Table 1: Comparison of the heart rate (beats/min) among the two groups

Time interval	Group C	Group L	P value
Baseline	86.4 ± 5.4	87.8 ± 7.3	>0.05
At induction	91.2 ± 4.7	94.4 ± 4.1	>0.05
1 Min after intubation	90.4 ± 7.6	107.9 ± 7.7	**<0.05**
3 Min after intubation	88 ± 7.6	102.7 ± 6.9	**<0.05**
10 Min after intubation	93.6 ± 8.4	108.9 ± 5.8	**<0.05**
30 Min after intubation	83.2 ± 3.1	85.5 ± 4.3	>0.05
60 Min after intubation	82.6 ± 2.7	84.2 ± 3.3	>0.05
90 Min after intubation	83.4 ± 1.9	85.5 ± 2.9	>0.05

Table 2: Comparison of systolic blood pressure (mm of Hg) among the two groups

Time interval	Group C	Group L	P value
Baseline	119.4 ± 5.9	120.2 ± 6.1	>0.05
At induction	124.5 ± 5.5	127.9 ± 6.2	>0.05
1 Min after intubation	120.5 ± 5.4	138.4 ± 8.5	**<0.05**
3 Min after intubation	118.6 ± 7.7	134.6 ± 8.6	**<0.05**
10 Min after intubation	109.2 ± 6.9	124.7 ± 8.7	**<0.05**
30 Min after intubation	119.4 ± 2.4	121.5 ±1.7	>0.05
60 Min after intubation	123.5 ± 3.5	125.4 ± 2.5	>0.05
90 Min after intubation	126.5 ± 3.9	127.6 ± 2.3	>0.05

Table 3: Comparison of diastolic blood pressure (mm of Hg) among the two groups

Time interval	Group C	Group L	P value
Baseline	75.52 ± 2.27	76.20 ± 2.24	>0.05
At induction	77.92 ± 4.04	80.88 ± 3.53	>0.05
1 Min after intubation	76.00 ± 4.64	89.14 ± 3.70	**<0.05**
3 Min after intubation	73.74 ± 5.99	88.22 ± 3.39	**<0.05**
10 Min after intubation	72.18 ± 6.72	86.70 ± 5.09	**<0.05**
30 Min after intubation	80.5 ± 2.36	83.88 ± 2.23	>0.05
60 Min after intubation	82.62 ± 2.3	84.5 ± 2.22	>0.05
90 Min after intubation	84.3 ± 3.4	87.15 ± 2.56	>0.05

Discussion

Laryngoscopy and endotracheal intubation are associated with marked haemodynamic stress response and autonomic nervous system hyperactivity. This may be a cause of concern in many high risk patients and geriatric patients**.** With increasing age cardiac vagal tone decreases and sympathetic nervous system activity increases. Also there is decrease in baroreceptor sensivity and decreased response to β adrenergic receptor stimulation.The hyperkinetic circulation seen is characterized by elevation in heart rate and blood pressure.[17-19] So in our study, we selected an optimal age group of 20 to 55 years. Readings were recorded during laryngoscopy and tracheal intubation and then at 1 min, 3 mins, 10 mins, 30 mins, 60 mins, and 90 mins, following endotracheal intubation. Heart rate, Systolic blood pressure and diastolic blood pressure (at 1 min, 3 min and 10 min after intubation) were significantly lower in group C as compared to Group L ($P < 0.05$). However at 30 mins, 60 mins and 90 mins after intubation, the haemodynamic parameters were comparable in both the groups ($P > 0.05$). No any significant episode of hypotension or bradycardia were noted in any group. Altan *et al.*[20] observed significant incidences of bradycardia and hypotension in their study in which they used clonidine 3 µg/kg intravenously over a period of 15 minutes as bolus dose before intubation and 2 µg/kg/hour by continuous infusion intraoperatively. Ray *et al.*[21] also observed significant incidences of bradycardia and hypotension in their study when they administered clonidine 3 µg/kg intravenously 15 minutes before intubation as bolus and infusion of 1 µg/kg/hour intraoperatively. We used clonidine 2.25 µg/kg intravenously 15 minutes before induction and infusion of 1.2 µg/kg/hour intraoperatively. Fall in blood pressure and pulse rate was noticed in patients receiving clonidine, but there was no episode of hypotension or bradycardia observed in any patient. Alpha-2 adrenoreceptors agonists cause a fall in blood pressure and heart rate and thus are protective against the pressure response to intubation and against the rise in arterial pressure

occuring during laparoscopic surgeries.[22] Lignocaine in previous studies has been found to attenuate the haemodynamic response to anaesthesia induction. [23, 24]

In our study, both clonidine and lignocaine lowered the haemodynamic stress response to intubation and to pneumoperitoneum but clonidine was found to be more effective than lignocaine in attenuating the haemodynamic response.

Conclusion

The haemodynamic stress response during laryngoscopy and due to insufflation of peritoneal cavity with carbon dioxide in laparoscopic surgery can be reduced by the use of infusions of clonidine and lignocaine. In comparison to lignocaine, clonidine was found to be more effective in control of the haemodynamic responses occurring during laparoscopic cholecystectomy.

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