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Original Research Article

Hemodynamic Changes During Laproscopic Cholecystectomy at Lumbini Medical College

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ABSTRACT:

Introduction: Laparoscopic cholecystectomy is preferred to open cholecystectomy for several reasons. Patients can be discharged home earlier. They have less pain in comparision to open cholecystectomy. This study aims to investigate the pneumoperitoneum-induced haemodynamic and ventilatory changes in patients undergoing laparoscopic cholecystectomy (LC). **Methods**: It was a prospective study comprising 400 patients of the age 15 years to 75 years of both sex (males *n*=80 and females *n*=320). The study was conducted in Lumbini Medical College Palpa over the two year period in Jan 2010 and Dec 2012. The variables recorded were: Mean arterial pressure (MAP), End-tidal CO_2, Peak and plateau airway pressures and heart rate. Data were collected immediately after induction of anesthesia at five minutes after peritoneal insufflations and tilting the table into 30° head-up position at 10 min and finally at 10 min after exsufflation. **Results**: There was decrease in MAP after head up position but there was little change after pneumoperitoneum. More the weight of the patients, more is the increased airway pressure. The end tidal CO_2 remained increased after pneumoperitoneum. **Conclusion**: Peritoneal insufflation of CO_2 to create the pneumoperitoneum and tilting the patient to the head-up position necessary for laparoscopy induces intraoperative ventilatory and hemodynamic changes that complicate anesthetic management of laparoscopy.

Keywords: capnography • haemodynamic changes • laproscopic cholecystectomy • pneumoperitoneum

INTRODUCTION:

Laparoscopic Cholecystectomy (LC) is preferred to open cholecystectomy (OC) for several reasons.[1] Patients are characterized by physiological alterations in circulatory and respiratory functions during LC.[2] Old patients are more prone to haemodynamic changes than are younger patients.[3] Several investigators have studied on the haemodynamic consequences of a LC in ASA I-II young and healthy patients.[4-6] There is alterations in the ventricular loading conditions resulting from the increased intra abdominal pressure.[7] All these studies indicated that haemodynamic alterations are potentially deleterious in patients such as elderly patients with limited cardiac reserve. Also, the pneumoperitoneum in a head-up position is responsible for ventilatory changes.[8] The respiratory behaviour in the elderly during this type of surgery is unknown.[9]

METHODS:

All 400 patients between 15 to 75 years of age with ASA grade I-II who underwent LC were included in this study. Informed consent and weight of all the patients were taken before surgery. All patients were premedicated with 0.15 mg/kg diazepam the day before surgery. General anesthesia (GA) was induced with 0.8mg/kg pethidine, 5 mg/kg of thiopentone sodium. Injection vecuronium

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0.1 mg/kg was given to facilitate tracheal intubation and maintenance of anaesthesia. After tracheal intubation, GA was maintained with nitrous oxide (60%) in oxygen and halothane. Non invasive arterial blood pressure, electrocardiogram (ECG), heart rate, capnography, and pulse oximetry were monitored during surgery. The expired end-tidal CO_2 was monitored continuously by a mainstream or side stream analyzer. During laparoscopy, intraabdominal pressure was maintained at 12 to 14 mm Hg by a CO_2 insufflator. The variables recorded were: Mean arterial pressure, End-tidal CO_2, Peak and plateau airway pressures and heart rate. Data were collected immediately after induction of anesthesia at 5 min, after peritoneal insufflations and tilting the table into 30° head-up position at 10 min (routine procedure during LC) and finally at 15 min after exsufflation.

RESULTS:

The maximum number of cases were between the age 26-35 (24%) in females and 46-55 (4.75%) in males. There were total of 320 (80%) females and 80 males (20%). The male: female ratio is 1:4. Table 1 shows that higher the weight of the patients more the change in airway pressure. The change in airway pressure after CO_2 insufflation was seen maximum in patients > 80 kg (average change of 8 cm of H_2O). This finding was statistically significant $p<0.05$.

Table 2 shows that the heart rate and the mean arterial pressure were increased after induction of anaesthesia in all patients. This increase was statistically not significant, $p>0.05$.

Table 3 shows that haemodynamic changes with respect to mean arterial pressure and heart rate are increased by 31.70% and 28.76 % respectively at the end of surgery but there is minimal change at 5 and 10 minutes. These changes were statistically significant $p<0.05$.

Ventilatory changes in Table 4 shows that Peak and plateau both airway pressure were decreased during head up position and both were increased at 5 and 10 minutes (41.18% and 72.73% at 10 minutes) of pneumoperitoneum which was statistically significant, $p<0.05$. End tidal CO_2 was increased by 25.45% after pneumoperitoneum was created (Table 5). This finding was statistically significant, $p<0.05$.

Table 1:Average change in airway pressure according to weight of the patients

Weight (kgs)	Airway pressure before insufflation	Airway pressure after insufflation	mean change
>80	22	30	8 (36.4%)
71-80	20	25	5 (25%)
61-70	19	23	4 (21%)
50-60	17	19	2 (11.7%)
<50	16	17	1.3 (8.1%)

Table 2: Hemodynamic changes before pneumoperitoneum (Mean value)

Hemodynamics	Before induction	After induction
Mean arterial pressure	82	89 (8.5% increased)
Heart rate	73	84 (15.07% increased)

Table 3: Hemodynamic changes after pneumoperitoneum (Mean value)

Hemodynamics	Before induction	At 5 minutes	At 10 minutes	End of surgery
Mean arterial pressure (mm Hg)	82	88 (increased by 7.31%)	93 (increased by 13.41%)	108 (increased by 31.70%)
Heart rate (per minute)	73	79 (increased by 8.22%)	76 (increased by 4.11%)	94 (increased by 28.76%)

Table 4: Ventilatory changes (Mean of 400)

Airway pressure (cm H_2O)	After induction	Head up position	Pneumoperitoneum at 5 minutes	Pneumoperitoneum at 10 minutes
Peak	17	14 (Decreased by 17.64%)	23 (increased by 35.3%)	24 (increased by 41.18%)
Plateau	11	10 (Decreased by 9.1%)	19 (Increased by 72.73%)	19 (increased by 72.73%)

Table 5: End tidal CO_2 (Mean of 400 patients)

Before pneumo-peritoneum	After pneumo-peritoneum	Percent change
22 mm Hg	27.6 mm Hg	25.45%

DISCUSSION:

This study shows that a CO_2 pneumoperitoneum and head-up tilt is well tolerated by all patients with regard to haemodynamic patterns and gas exchange. Similar studies have revealed that creation of CO_2 pneumoperitonium at 12–14 mmHg has not induced major haemodynamic changes.[10] Our study also reveals that some haemodynamic changes were observed during CO_2 pneumoperitoneum and head-up tilt .There was significant change ($p<0.05$) in mean arterial pressure and heart rate after pneumoperitoneum at the end of surgery. More is the weight of the patient, greater is the change in the air way pressure which was statistically significant ($p<0.05$) in our study. But lesser the weight minimum change in airway pressure was observed. In case of elderly patients they do have some physiological cardiac and circulatory alterations that resulted in a decrease in myocardial performance which alters the haemodynamic changes.[11] Cardiac preload could have compromised myocardial function.[12] LC procedures induce haemodynamic disturbances in ASA III-IV patients.[10,13] These occur even in healthy ASA I-II patients mainly because of decreased preload and increased afterload.[5,13-14] In our study there was increased level of end tidal CO_2. It was increased by 25.45 % ($p<0.05$). That is why the Monitoring of Et.CO_2 has been shown to be useful. Like in our study majority of other studies concerning gas exchanges during LC have reported an increase in EtCO_2. It is generally considered to be moderate in ASA I or II patients.[15] However, high levels of End tidal carbon dioxide have been described during LC, especially in patients with previous COPD or in ASA III-IV patients.[16] This is the reason that the End tidal CO_2 monitoring is essential during LC.

CONCLUSION:

Creation of pneumoperitoneum during LC can alter the haemodynamic and ventilatory parameters. The changes in End tidal CO_2, MAP, heart rate and ventilatory parameters are the main indicators used for hemodynamic stability of patients undergoing LC.

REFERENCES:

1. Joris J, Cigarini I, Legrand M, Jacquet N, De Groote D, Franchimont P et.al. Metabolic and respiratory changes after cholecystectomy performed via laparotomy or laparoscopy. Br J Anaesth. 1992;69(4):341-5.
2. Schauer PR, Luna J, Ghiatas AA, Glen ME, Warren JM, Sirinek KR. Pulmonary function after laparoscopic cholecystectomy. Surg. 1993;114:389-99.
3. Critchley LA, Critchley JA, Gin T. Haemodynamic changes in patients undergoing laparoscopic cholecystectomy: measurements by transthoracic electrical bio-impedance. Br J Anaesth. 1993;70:681-3.
4. Cunningham AJ, Turner J, Rosenbaum S, Rafferty T. Transoesophageal echocardiographic assessment of haemodynamic function during laparoscopic cholecystectomy. Br J Anaesth. 1993;70(6):621-5.
5. Joris J, Honore P, Lamy M. Changes in oxygen transport and ventilation during laparoscopic cholecystectomy. Anesthesiol. 1992;77(3A):A149.
6. Joris JL, Noirot DP, Legrand MJ, Jacquet NJ, Lamy ML. Hemodynamic changes during laparoscopic cholecystectomy. Anesth Analg. 1993;76(5):1067-71.
7. Mc Laughlin JG, Bonnell BW, Scheeres DE, Dean RJ. The adverse hemodynamic effects related to laparoscopic cholecystectomy. Anesthesiol. 1992;77:A70.
8. Joris J, Ledoux D, Honore P, Lamy M. Ventilatory effects of CO2 insufflation during laparoscopic cholecystectomy. Anesthesiol. 1991;75:A121.
9. Fox LG, Hein HAT, Gawey BJ, Hellman CL, Ramsay MAE. Physiologic alterations during laparoscopic cholecystectomy in ASA III and IV patients. Anesthesiol. 1993;79:A55.
10. Wahba RWM, Mamazza J. Ventilatory requirements during laparoscopic cholecystectomy. Can J Anaesth. 1993;40:206-10.
11. Feig BW, Berger DH, Dougherty TB, Dupuis JF, Hsi B, Hickey RC et al. Hemodynamic effects of CO2 abdominal insufflation (CAI) during laparoscopy in high-risk patients. Anesth Analg 1994;78:S109.
12. Gunnarsson L, Tokics L, Gustavsson H, Hedenstierna G. Influence of age on atelectasis formation and gas exchange impairment during general anaesthesia. Br J Anaesth. 1991;66:423-32.
13. Wittgen CM, Andrus CH, Fitzgerald SD, Baudendistel LJ, Dahms TE, Kaminski DL. Analysis of the hemodynamic and ventilatory effects of laparoscopic cholecystectomy. Arch Surg. 1991;126:997-1001.
14. Fitzgerald SD, Andrus CH, Baudendistel LJ, Dahms TE, Kaminski DL. Hypercarbia during carbon dioxide pneumoperitoneum. Am J Surg. 1992;163:186-90.
15. Feig BW, Berger DH, Dougherty TB, Dupuis JF, Hsi B, Hickey RC et al. Pulmonary effects of CO2 abdominal insufflation (CAI) during laparoscopy in high-risk patients. Anesth Analg. 1994;78:S108.
16. Wittgen CM, Naunheim KS, Andrus CH, Kaminski DL. Preoperative pulmonary function evaluation for laparoscopic cholecystectomy. Arch Surg. 1993;128:880-6.