



Anesthesiology

COMPARISON OF HEMODYNAMIC VARIABLES IN LAPAROSCOPIC CHOLECYSTECTOMY WITH TWO DIFFERENT PNEUMOPERITONEAL PRESSURE USING VIGILEO CARDIAC OUTPUT MONITOR

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ABSTRACT **BACKGROUND:** Laparoscopic surgery in patient with Comorbid disease poses unique challenge to anesthesiologist . We used different IAP and compared hemodynamic changes using vigileo cardiac output monitor

STUDY DESIGN: Prospective randomised study conducted in 60 patient undergoing Laparoscopic Cholecystectomy

Group A IAP between 10-12 mmHg
Group B IAP between 14-16 mmHg

HR,MAP,Cardiac Output and stroke volume were compared using unpaired sample t-test

RESULTS: Lesser fall in cardiac output and stroke volume and lesser increase in MAP in Group A compared to Group B

CONCLUSION: So lesser IAP can be used with minimally invasive cardiac output monitor for patients with limited cardiopulmonary reserve

KEYWORDS :

INTRODUCTION

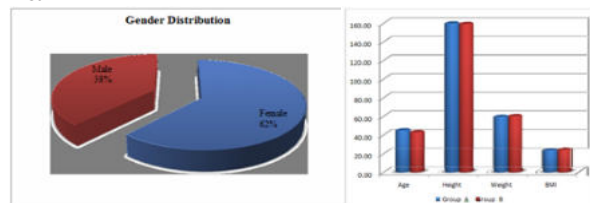
Laparoscopic surgery produces unique challenges to the anesthesiologist due to pneumoperitoneum , CO₂ insufflation and positioning. Hemodynamic perturbations produced by pneumoperitoneum are like decrease in cardiac out and increase in mean arterial pressure, may not be tolerated by the patients with compromised cardiopulmonary reserve. A minimally invasive cardiac output monitor like Vigileo FloTrac through an arterial line , measures cardiac output from pulse contour analysis, enable us to identify the deleterious effect and thus intervene early.

OBJECTIVE

The aim of the study was to compare the hemodynamic changes like cardiac output, stroke volume, Heart rate, and Mean arterial pressure in laparoscopic cholecystectomy with two different pneumoperitoneal pressure using minimally invasive Vigileo FloTrac cardiac output monitor.

METHODOLOGY

Sixty patients of ASA PS I of both sex, aged 18 to 60 years with no comorbid disease were randomized into two groups . In Group A - pneumoperitoneal pressure was set between 10 - 12 mmHg, Group B - pneumoperitoneal pressure was set between 14 - 16 mmHg . After approval from ethical committee and written informed consent, n=60 patients was selected for the study based on the inclusion and exclusion criteria. Sample size was calculated as 30 in each group, using 't' test analysis. Keeping the power of study as 80% and confidence limit at 95% to detect a 10% change in cardiac output and mean arterial pressure, the minimum sample size required was 29 in each group. We included 30 patients in each group for better validation of results. Using a lot, selection of patients was randomly assigned to two groups A & B



ANEASTHETIC TECHNIQUE

Following placement of standard monitors, intravenous line , the patency of collaterals in hand was checked by Allen's test . After infiltrating 2% lignocaine the patients radial arterial was cannulated with 20 G arterial cannula and connected to FloTrac sensor of Vigileo monitor. The patients was started on an infusion of Ringer's lactate at the rate of 10ml/kg/hr through an 18 gauge cannula. Following glycopyrolate 0.05mg/Kg, anaesthesia was induced with 0.02 mg/Kg of midazolam, 2µg/Kg of fentanyl and 2mg/Kg of propofol. Endotracheal intubation was facilitated with 0.1 mg/kg of Vecuronium bromide and mechanical ventilation was set with a tidal volume of 8ml -10ml/Kg and respiratory frequency was adjusted to achieve an end

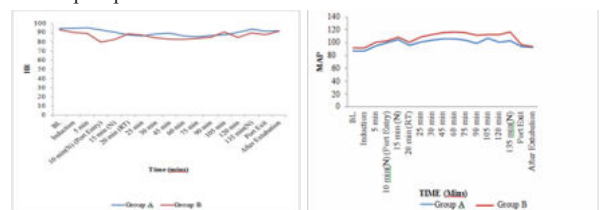
tidal CO₂ of 35 - 40mm of Hg and airway pressure maintained between 18-20cm of H₂O. Sevoflurane 1-2% in a mixture of oxygen (50%) and Nitrous oxide (50%) was used for maintenance.

EXPERIMENTAL PROTOCOL

For each Group A&B baseline HR, Mean Blood Pressure (MBP), Stroke Volume (SV), Cardiac Output (CO), were documented 5 min before & after intubation (B₁) to eliminate the bias of intubation response. Baseline registration of variables were obtained immediately before Pneumoperitoneum (B₂), which were measured every 5 min after Pneumoperitoneum was initiated. The positional influences on cardiac output, stroke volume, were measured for reverse Trendelenberg and neutral position also recorded. Then one more value after deflation is also recorded. After completion of surgery and after adequate spontaneous respiratory attempts patient reversed with Inj. Neostigmine 0.05 mg/kg with Inj. Glycopyrolate 0.01 mg/kg and extubated after adequate signs of recovery.

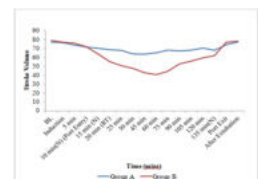
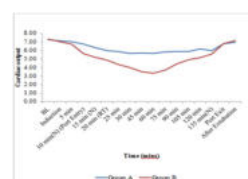
RESULTS

We observed that there is a statistically significant reduction of cardiac output and stroke volume and increase in mean arterial pressure in Group B-Intra abdominal pressure of 14 - 16 mmHg compared to Group A - IAP of 10 - 12 mmHg. There is no significant difference observed in HR in both groups. The primary outcome measure compared between two groups was cardiac output, stroke volume. In our study we found that there was significant decrease in SV, CO and increase in MAP, immediately after insufflation of CO₂ pneumoperitoneum and more pronounced after reverse Trendelenberg position and it remained so throughout the surgery. All these parameters returned to baseline after deflation of pneumoperitoneum in the supine position.



Observation
Comparison Of Heartrate

Comparison Of Mean Arterial Pressure



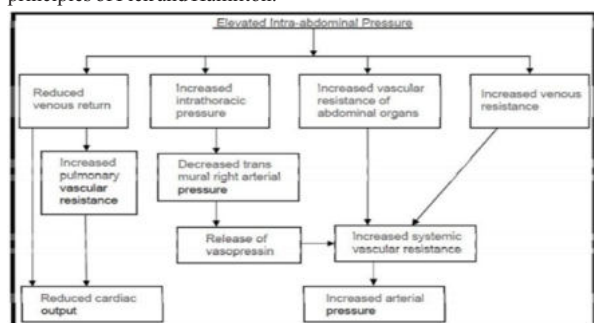
Comparison Of Cardiac Output

Comparison Of Stroke Volume



DISCUSSION

Cardiac output monitoring has undergone a tremendous advancement in recent two decades only. Though circulation of blood was discovered by Harvey, more than 300 years ago, only by 1970 Swan, Ganz and colleagues had done a successful pulmonary artery catheter (PAC) by the use of specially designed balloon tipped catheter and measured cardiac output. PAC insertion is an invasive procedure. Ideal technique for CO measurement should be non-invasive, accurate, reliable, continuous, and compatible in adult and paediatric patients. Recent advances had lead to development of minimally invasive and non-invasive method. Vigileo cardiac output monitor with FloTrac sensor system, was one of the recent development in minimally invasive cardiac output monitoring, generally used for assessing intraoperative fluid requirements using SVV -stroke volume variation. The future of CO monitoring lies in the physiological principles of Fick and Hamilton.



HEMODYNAMIC COMPLICATIONS OF LAPAROSCOPIC SURGERY

Alterations in hemodynamics are due to changes resulting from the varied effects of CO₂ pneumoperitoneum, positioning of the patient, anaesthesia and hypercapnia. Hemodynamic changes are characterized by decreased venous return and cardiac output, increase in mean arterial pressures due to increase in systemic vascular resistance and peripheral vascular resistance.

In spite of the observed changes such as decreased cardiac output, decreased stroke volume and increased mean arterial pressure in higher pneumoperitoneal pressure group, no cardiopulmonary complications occurred in both groups of patients. This is because that our study included only ASA I & II patients with no other co morbid disease. But this is not expected in the patients with limited cardiopulmonary reserve like old age and coronary arterial disease. Thus lower intra-abdominal pressure should be used in patients with compromised cardiopulmonary reserve like old age, CAD with precised monitoring of beat to beat variation in hemodynamic variables. Therefore a minimally invasive cardiac output monitor like Vigileo with FloTrac sensor may be considered in patients with concomitant cardiopulmonary disease, who is undergoing laparoscopic cholecystectomy. For these patients the intra operative decrease in cardiac output can be recognized and intervened early, thus enabling then less fit patients to reap the benefits of laparoscopy.

FloTrac Vigileo monitor can provide continuous real time hemodynamic data with a rapid response to acute changes and may have a role in minimal invasive hemodynamic monitoring during laparoscopic procedures in older patients with cardiovascular disease.

CONCLUSION

A prospective randomized study conducted to compare hemodynamic with two different pneumoperitoneal pressure, concluded that significant decrease in stroke volume, cardiac output and increase in MAP were observed when the intra-abdominal pressure was 14 - 16 mmHg compared to intra-abdominal pressure was 10 - 12 mmHg without differences in Heart rate. Hence we conclude that laparoscopic cholecystectomy can be done with a lesser hemodynamic perturbation in older patients with cardio vascular disease using a lesser intra-

abdominal pressure of 10 - 12 mmHg with a minimally invasive cardiac output monitor.

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- Wahba RW and associates⁷⁹ Changes in cardio vascular functions due to the insufflations are characterized by an immediate decrease in cardiac index and an increase in MAP and SVR.
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- Anderey Hyde, Eric Mills et al⁸¹ concluded that insufflation of CO₂ resulted in statistically significant decrease in SV, increase in SVV, MAP and SVR with no change in CO.
- Darlong V et al⁸² Effect on hemodynamic changes and experience of robot-assisted laparoscopic radical prostatectomy (RALRP) in steep Trendelenberg position (45°) with high-pressure CO₂ pneumoperitoneum using Vigileo FloTrac
- Meininger D et al.⁸³ The study was designed to evaluate hemodynamic changes associated with head-down positioning and prolonged pneumoperitoneum during totally endoscopic robot-assisted radical prostatectomy using PICCO system