

HEMODYNAMIC CHANGES INDUCED BY PNEUMOPERITONEUM AND POSITION CHANGE MEASURED WITH ECOM

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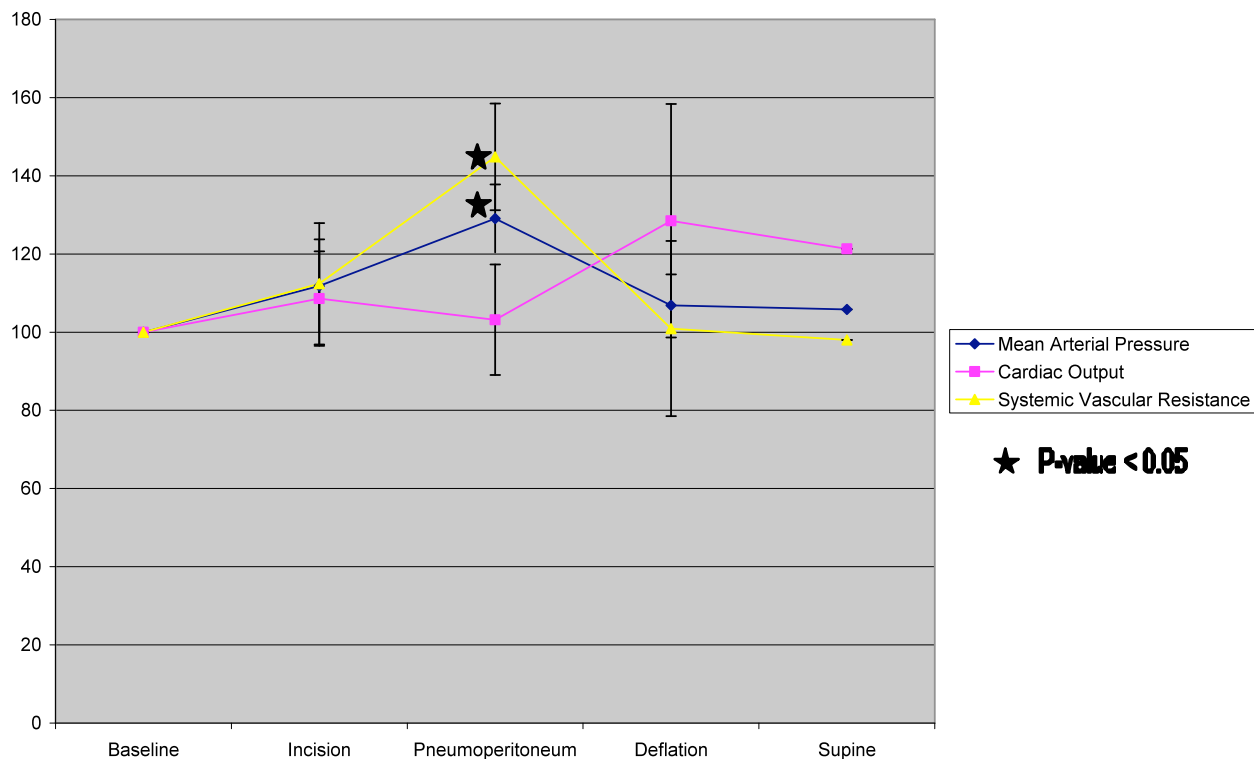
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Introduction: Laparoscopic surgery presents unique hemodynamic challenges for the anesthetic management of patients. Hemodynamic changes induced by pneumoperitoneum were measured using a new noninvasive device, the Endotracheal Cardiac Output Monitor (ECOM) (ConMed Corp, Utica, NY). This monitor provides measurements – including cardiac output (CO), systemic vascular resistance (SVR), and stroke volume variation (SVV) – that were previously unavailable noninvasively. A better understanding of the applicability and reliability of this new technology in the clinical setting is important for patient safety.

Methods: Hemodynamic parameters were measured using ECOM during laparoscopic surgery with the patients undergoing general anesthesia. ECOM requires an invasive arterial line for measuring blood pressure (BP), and a noninvasive endotracheal tube to measure bioimpedance of the blood flow through the ascending aorta. Cardiac output is calculated from these measurements. Data for cardiac output, systemic vascular resistance, and other hemodynamic parameters were collected with ECOM in seven patients. Measurements were recorded throughout the operation and insufflation and pneumoperitoneum release were noted. The data were analyzed using the paired two-sided T test using Microsoft Excel to find any significant changes from baseline in mean arterial pressure, cardiac output or systemic vascular resistance. The average increase from the baseline, the standard deviation, and the p-values were calculated. p-values <0.05 were considered statistically significant.

Average Values of Hemodynamic Parameters for Various Events During Surgery



Results: On average, pneumoperitoneum caused a 29.1% increase in blood pressure, a 3.2% increase in cardiac output, and a 44.9% increase in systemic vascular resistance ($p < 0.05$). As shown in Figure, surgical incision induced an increase in the three monitored indices (MAP, CO and SVR), but this increase was not significant. In contrast, the induction of pneumoperitoneum resulted in a significant increase in MAP and SVR, and a concomitant decrease in CO. These changes in MAP and SVR reverted to baseline upon release of pneumoperitoneum (Figure).

Conclusion: These findings of significant increase in MAP and SVR are consistent with those found in literature (1-4) in cases where the parameters were measured invasively via pulmonary artery catheters. Based on these preliminary data, it appears that ECOM-derived hemodynamic changes reflect those obtained invasively. Therefore, ECOM's noninvasive method to measure CO may be preferable in those patients in whom invasive monitoring is difficult or contraindicated.

Although this study focused on the hemodynamic effects of pneumoperitoneum for laparoscopic surgery, there are other factors – such as respiratory and positional changes – that could affect the hemodynamic parameters. For future research, a more controlled study is planned.

References:

1. Galizia G, Prizio G, Lieto E, et al: *Surgical Endoscopy* 2001; 15(5):477-83
2. Haxby EJ, Gray MR, Rodriguez C, et al: *Br J Anaesth* 1997; 78(5):515-9.
3. Struthers AD, Cuschieri A: *Lancet* 1998; 352(9127):568-70.
4. Nguyen NT, Ho HS, Fleming NW, et al: *Surgical Endoscopy* 2002; 16(1):78-83.