Effect of rapid increase in intra-abdominal pressure on pleth variability index in healthy women undergoing gynecological laparoscopy

Malgorzata Barud¹, Ziemowit Rzecki¹, Magdalena Bielacz², Hanna Brzozowska¹, Paulina Iwaniuk¹, Daniel Pietrzak¹, Wojciech Dabrowski¹

1. Department of Anaesthesiology and Intensive Therapy Medical University of Lublin, Poland, 2. State School of Higher Education, Zamosc, Poland

Increase in intra-abdominal pressure (IAP) impairs circulatory system via depression of cardiac function. An increase in IAP under 12 mmHg, called intra-abdominal hypertension, may result from abdominal trauma, massive fluid resuscitation, pregnancy and pneumoperitoneum. Rapid increase in IAP elevates diaphragm and presses abdominal vessels reducing actively circulated blood volume, which may affect blood pressure and increase pulse variability. Pleth variability index (PVI) is a novel parameter presented the dynamic changes in peripheral perfusion index (PI) during comparable respiratory cycles [1]. Several authors have documented a usefulness of PVI early hypovolaemia detection [1,2]. However, an increase in IAP and subsequent decrease in blood return from the limb and abdomen may affect PVI.

The purpose of this study was to analyze the changes in PVI in patients undergoing gynecological laparoscopy.

Methods

Adult women undergoing elective laparoscopy with IAH = 15 mmHg, under general anaesthesia were enrolled. After tracheal intubation, mechanical ventilation with the mixture of air and oxygen (inspired oxygen concentration- 40%) was provided. All the patients were ventilated using intermittent positive pressure ventilation (IPPV) with the following ventilation parameters: tidal volume 5-6 mL/kg body wt and respiratory rate, which was adjusted to maintain normocapnia, controlled by capnography. All patients received crystalloids infusion at the dose of 10 mL/kg body wt during anaesthesia. Half of this dose was infused immediately after anaesthesia induction. PVI was monitored using Masimo Root monitor (Irvine, Ca, USA). Heart rate (HR), mean arterial pressure (MAP) and PVI were analysed in four time points:

- A - just after anaesthesia induction, before surgery (baseline),
- B - 5 min after induction of IAH,
- C - during IAH in Trendelenburg position,
- D - just after surgery, before completion of anaesthesia.

Results

40 women aged 22 – 48 (mean 35 ± 5) were studied.

Mean duration of surgery was 53 ± 28 min.

IAH decreased whereas HR increased following an induction of IAH (Fig. 1).

PVI increased immediately after an induction of IAH (Fig 1).

Trendelenburg position slightly corrected PVI, however its value was still significantly higher than baseline. Δ PVI correlated with Δ MAP (absolute values at time points B – A) – Fig. 2

Conclusions.

Rapid induction of IAH increase value PVI. Changes in PVI correspond with changes in MAP.

Fig.2. Correlation between PVI and MAP

Fig.1. Changes in MAP, HR and PVI in anesthetized patients undergoing gynecological laparoscopy.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ – comparison with baseline.