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CASE REPORT

Effect of Pneumoperitoneum on Pulse Oximeter Plethysmographic Wave form: A Case Report

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ABSTRACT

Laparoscopic surgeries utilize CO_2 pneumoperitoneum to enhance the surgical field, but it can induce significant physiological changes. This case report presents a 46-year-old male undergoing transabdominal preperitoneal (TAPP) repair for bilateral inguinal hernia, during which notable changes in the plethysmographic waveform were observed within 30 seconds of CO_2 insufflation. These findings highlight the impact of intra-abdominal pressure on peripheral perfusion, emphasizing the need for vigilant intraoperative monitoring.

KEYWORDS: Laparoscopy, Pneumoperitoneum, Pulse oximetry

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INTRODUCTION

CO_2 pneumoperitoneum is widely used in laparoscopic procedures; however, its physiological consequences include hemodynamic alterations and changes in peripheral perfusion.[1] The plethysmographic waveform, derived from pulse oximetry, serves as a non-invasive indicator of these effects. It provides insights into variations in peripheral blood flow, making it a valuable monitoring tool during surgeries involving increased intra-abdominal pressure. While numerous studies have examined the hemodynamic effects of CO_2 insufflation, limited literature explores its impact on plethysmographic waveform patterns. This case report presents a scenario in which the plethysmographic waveform showed marked alterations following pneumoperitoneum initiation, warranting discussion on its clinical significance. Written informed consent for publication was taken from the patient.

CASE

A 46-year-old male patient having right inguinal hernia scheduled for TAPP repair under general anaesthesia. His vital parameters were within normal limits, with a blood pressure (BP) of 125/90 mmHg, a hear rate (HR) of 87 beat/minute, and oxygen saturation (SpO_2) of 100% on room air.

Patient anaesthesia was induced with intravenous fentanyl 2 µg/kg, propofol 2 mg/kg) and vecuronium 0.08 mg/kg. Endotracheal intubation was performed using an 8 mm ID tube, and anaesthesia was maintained with a mixture of 50% oxygen in air and sevoflurane. The surgery proceeded with CO_2 insufflation initiated via a Veress needle at a flow rate of 5 L/min, targeting an intra-abdominal pressure of 15 mmHg. After 30 seconds of CO_2 insufflation, significant alterations were observed in the plethysmographic waveform. A marked decrease in waveform amplitude occurred, which gradually progressed to near disappearance (Figure 1). This attenuation persisted momentarily and subsequently recovered as intra-abdominal pressure stabilized. Concurrently, changes in hemodynamic parameters were noted, particularly a decrease in heart rate and blood pressure. Throughout the intraoperative course, a sequential decline in HR was recorded, dropping from 85 beat/min at baseline to 78 beat/min at one minute,

Figure 1: Plethysmographic waveform variation after pneumoperitoneum.

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70 beat/min at two minutes, and 68 beat/min at five minutes. Blood pressure was also fluctuated, with an initial recording of 98/68 mmHg, followed by 95/61 mmHg, before stabilizing at 100/69 mmHg by five minutes. Interestingly, SpO_2 remained stable at 97–98% throughout the procedure (Table 1). These findings suggest that CO_2 insufflation led to transient but significant hemodynamic alterations, affecting both central and peripheral circulation.

DISCUSSION

CO_2 pneumoperitoneum is known to induce cardiovascular changes by increasing intra-abdominal pressure, which in turn affects venous return, stroke volume, and cardiac output.[2] The plethysmographic waveform serves as an indirect measure of these changes, reflecting alterations in peripheral circulation. Studies have demonstrated that intra-abdominal insufflation causes a reduction in stroke volume and modifications in the pleth variability index (PVI), which correlate with reduced perfusion.[3]

Several mechanisms have been proposed to explain these changes. Increased intra-abdominal pressure elevates systemic vascular resistance, leading to a compensatory decrease in cardiac output. Additionally, compression of the inferior vena cava reduces venous return, further exacerbating hemodynamic fluctuations.[3] These factors contribute to the transient attenuation observed in the plethysmographic waveform immediately following CO_2 insufflation. The rapid attenuation and gradual normalization of the plethysmographic waveform observed in this case are consistent with previous reports. Wajima *et al.*[4] demonstrated that plethysmographic variability is a sensitive marker of intraoperative hemodynamic shifts during laparoscopic procedures. Similarly, Liu *et al.*[2] highlighted that increased intra-abdominal pressure leads to a decrease in stroke volume variation, directly affecting pulse oximetry readings.

These findings underscore the importance of continuous monitoring of pleth height during laparoscopic surgeries. While transient, the hemodynamic alterations associated with CO_2 pneumoperitoneum can impact intraoperative management. Awareness of these changes allows anaesthesiologists to anticipate and mitigate potential complications, ensuring optimal patient safety.

Table 1: Intraoperative vitals parameters variation with time.

Time (min.)	HR (beat/ minute)	BP (mm Hg)	SpO_2 (%)	Plethysmographic waveform
0 min	85	98/68	97	Normal
1 min	78	98/68	98	Decreased amplitude
2 min	70	95/61	98	Further reduced amplitude
5 min	68	100/69	98	Gradual normalisation

CONCLUSION

This case highlights the immediate impact of CO_2 pneumoperitoneum on the plethysmographic waveform during laparoscopic surgery. The transient decrease in waveform amplitude, correlating with hemodynamic changes, underscores the influence of intra-abdominal pressure on peripheral perfusion. These findings emphasize the need for vigilant intraoperative monitoring to optimize patient safety and surgical outcomes.

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