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脉搏灌注变异指数监测在腹腔镜胆囊切除术患者中的应用

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[摘要] **目的** 研究全麻下行腹腔镜胆囊切除术患者脉搏灌注变异指数(PVI)的变化趋势及术前基础PVI值的影响因素。**方法** 选择ASA分级为I~II级的67例腹腔镜胆囊切除术患者,年龄18~65岁,入室后持续监测患者心率(HR)、收缩压(SBP)、舒张压(DBP)、平均动脉压(MAP)及脉搏血氧饱和度(SpO₂),利用Masimo(Radical-7, USA)监测灌注指数(PI)及PVI值的变化。麻醉诱导前快速输注平衡液10 mL/kg,诱导后均以丙泊酚复合瑞芬太尼静脉全麻。**结果** 患者平均基础PVI值为(16.8±6.3)%,全麻诱导后PVI下降至(10.3±5.4)%,气腹建立后又升至(21.2±9.5)%。年龄<45岁的患者术前基础PVI值高于≥45岁的患者[(19.2±6.5)% vs (15.5±5.9)%, $P<0.05$];男性患者术前基础PVI值高于女性患者[(18.8±7.5)% vs (15.35±4.8)%, $P<0.05$];体质指数(BMI)与术前基础PVI没有显著关联。**结论** 患者入室平均PVI高于14%,提示存在容量不足。年龄因素和性别因素均与术前基础PVI值相关,即男性和年龄<45岁的患者术前基础PVI值更高。

[关键词] Masimo 脉氧监测仪;脉搏灌注变异指数;腹腔镜胆囊切除术**[中图分类号]** R 657.4**[文献标志码]** A**[文章编号]** 0258-879X(2013)01-0050-03

Application of pleth variability index monitoring in patients receiving laparoscopic cholecystectomy

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[Abstract] **Objective** To study the changes of pleth variability index (PVI) in patients receiving laparoscopic cholecystectomy under general anesthesia, and to investigate the clinical influencing factors of pre-operation baseline PVI value. **Methods** Totally 67 patients undergoing laparoscopic cholecystectomy with ASA I-II, aged 18 to 65 years old, were included in the present study. The heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), pulse oximetry (SpO₂), perfusion index (PI), and PVI value were monitored with a Masimo pulse oxygen monitor (Radical-7, USA) after entering the operation room. Fluid expansion with 10 mL/kg of balanced solution was given before the induction. Anesthesia was maintained under total intravenous anesthesia (TIVA) with propofol and remifentanyl. **Results** The average baseline PVI value was (16.8±6.3)% in the patients; then it decreased to (10.3±5.4)% after induction of anesthesia and increased to (21.2±9.5)% after establishment of pneumoperitoneum. The pre-operation baseline PVI value ((19.2±6.5)%) of patients <45 years old was significantly higher than that in patients ≥45 years old ((15.5±5.9)%, $P<0.05$). Male patients had a significantly higher PVI ((18.8±7.5)%) value than female patients ((15.3±4.8)%, $P<0.05$). Body mass index (BMI) was not significantly associated with pre-operation baseline PVI. **Conclusion** The baseline value of PVI is higher than 14%, suggesting insufficient volume load in most of patients. Age and sex are both associated with pre-operation PVI value; male patients and those <45 years old have a higher pre-operation baseline PVI value.

[Key words] Masimo pulse oxygen monitor; pleth variability index; laparoscopic cholecystectomy

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脉氧饱和度监测仪是危重病救治和麻醉手术等多种临床情况下的无创性监测工具,有助于发现患者病情变化,指导临床治疗^[1]。脉搏灌注指数(PI)和脉搏灌注变异指数(PVI)是新型脉氧饱和度监测

仪的重要测量指标,多项临床研究证实,在围术期和ICU机械通气患者中监测PVI可有效预测容量状态^[2-3]。本研究动态监测了全麻下行腹腔镜胆囊切除术患者PVI的变化趋势,并分析了术前基础PVI

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的相关影响因素,为指导患者的术前补液提供参考。

1 材料和方法

1.1 研究对象 随机选取第二军医大学长海医院麻醉科 ASA I~II 级的行腹腔镜胆囊切除术患者,排除合并心律失常、高血压、心力衰竭、严重外周血管病变等疾病的患者。

1.2 麻醉方法 麻醉诱导前以 10 mL/kg 平衡液快速扩容,麻醉诱导静注咪达唑仑 0.04 mg/kg、丙泊酚 1~2 mg/kg、芬太尼 2~3 $\mu\text{g}/\text{kg}$ 和罗库溴铵 0.6 mg/kg,经口气管内插管。麻醉维持均以丙泊酚 1~2 mg/(kg·min)复合瑞芬太尼 0.4 $\mu\text{g}/(\text{kg}\cdot\text{min})$ 全麻。

1.3 监测指标 患者入手术室行心电监护及脉搏血氧饱和度(SpO_2)、无创血压监测,记录心率(HR)、收缩压(SBP)、舒张压(DBP)、平均动脉压(MAP)及 SpO_2 ;采用新型脉氧饱和度监测仪 Masimo (Radical-7, USA) 监测并记录 PI 及 PVI 值。

1.4 术前 PVI 的影响因素分析 根据年龄(<45 岁、 ≥ 45 岁)、性别(男、女)、体质量指数(BMI)($< 24 \text{ kg}/\text{m}^2$ 、 $\geq 24 \text{ kg}/\text{m}^2$) 进行分组,比较组间 PVI 差异,考察年龄、性别、BMI 对 PVI 的影响。

1.5 统计学处理 采用 SPSS 17.0 统计学软件分析数据,计量资料以 $\bar{x}\pm s$ 表示,采用 t 检验比较组间差异,检验水平(α)为 0.05。

2 结果

2.1 一般情况 共纳入 67 例患者,均顺利完成手术。其中男性 37 例,女性 30 例;年龄 18~65 岁,平均年龄(48.8 ± 13.4)岁;BMI (23.4 ± 3.3) kg/m^2 。平均手术时间为(1.2 ± 0.4) h,预输液量(627.8 ± 140.0) mL,总输液量($1\ 117.2\pm 167.1$) mL。

2.2 患者血流动力学变化 患者入室平均 HR 为(75.7 ± 11.9)/min, MBP 为(90.2 ± 12.6) mmHg (1 mmHg=0.133 kPa);诱导后 HR 无明显变化,MBP 降至(76.4 ± 12.3) mmHg,与入室时比较,差异有统计学意义($P<0.05$);气腹建立后 HR 降至(68.7 ± 10.3)/min, MBP 回升至(87.3 ± 14.6) mmHg,与诱导后比较,差异均有统计学意义($P<0.05$);随后整个麻醉期间患者 HR 维持于 64.8~68.7/min (图 1), MBP 维持于 78.0~80.4 mmHg (图 2)。

2.3 患者脉搏波参数变化 患者入室时平均 PI 为(2.1 ± 1.5)%, PVI 为(16.8 ± 6.3)%;诱导后患者 PI 升高至(5.1 ± 2.8)%, 而 PVI 降低至($10.3\pm$

5.4)%;气腹建立后 PI 迅速降低至(1.2 ± 0.9)%, PVI 则升至(21.2 ± 9.5)%, 见图 3。

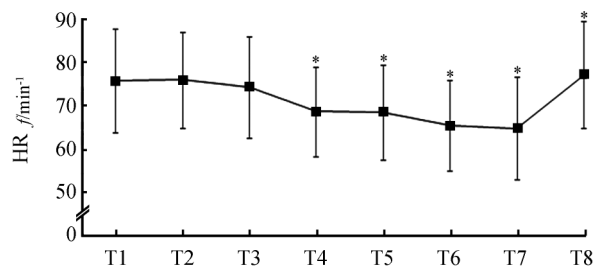


图 1 围手术期患者心率变化

Fig 1 Changes of HR during the peri-pneumoperitoneum period

HR: Heart rate. T1: Entering operating room; T2: After infusion; T3: After induction; T4: After pneumoperitoneum; T5: Before deflation; T6: 5 min after deflation; T7: 5 min after withdrawal; T8: Before leaving operating room.

* $P<0.05$ vs T3, $n=67$, $\bar{x}\pm s$

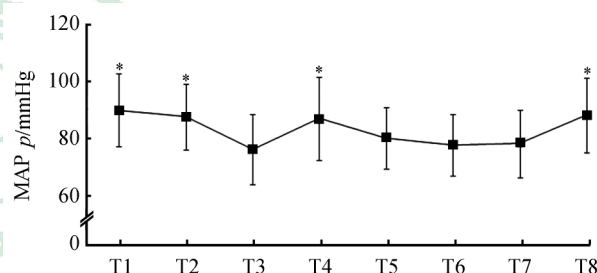


图 2 围手术期患者平均动脉压变化

Fig 2 Changes of MAP during the peri-pneumoperitoneum period

MAP: Mean arterial pressure. T1: Entering operating room; T2: After infusion; T3: After induction; T4: After pneumoperitoneum; T5: Before deflation; T6: 5 min after deflation; T7: 5 min after withdrawal; T8: Before leaving operating room.

1 mmHg=0.133 kPa. * $P<0.05$ vs T3, $n=67$, $\bar{x}\pm s$

2.4 术前基础 PVI 的影响因素 结果显示,年龄<45 岁的患者术前基础 PVI 值[(19.2 ± 6.5)%] $>$ 45 岁的患者[(15.5 ± 5.9)%],差异有统计学意义($P<0.05$);男性患者 PVI 值[(18.8 ± 7.5)%] $>$ 女性患者[(15.3 ± 4.8)%],差异有统计学意义($P<0.05$);BMI $< 24 \text{ kg}/\text{m}^2$ 与 $\geq 24 \text{ kg}/\text{m}^2$ 两组间 PVI 差异无统计学意义(图 4)。

3 讨论

PVI 反映 PI 在呼吸周期中的动态变化,可以为胸腔内压和血管内容量间平衡提供有效信息,能够有效预测容量状态^[2-3]。Cannesson 等^[4] 研究发现,

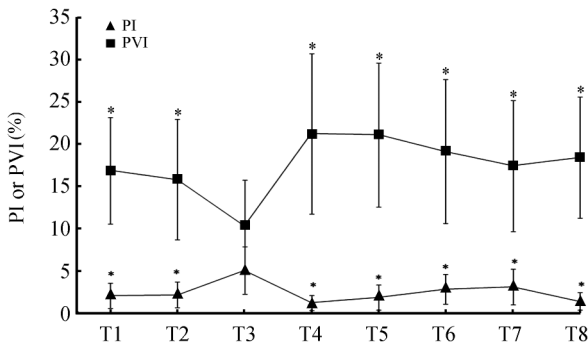


图3 围手术期患者脉搏波参数变化

Fig 3 Changes of PI and PVI during the peri-pneumoperitoneum period

PI: Perfusion index; PVI: Pleth variability index. T1: Entering operating room; T2: After infusion; T3: After induction; T4: After pneumoperitoneum; T5: Before deflation; T6: 5 min after deflation; T7: 5 min after withdrawal; T8: Before leaving operating room. * $P < 0.05$ vs T3. $n = 67$, $\bar{x} \pm s$

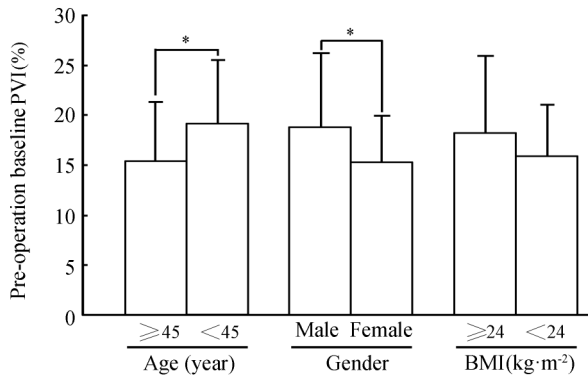


图4 术前基础脉搏灌注变异指数的影响因素

Fig 4 Factors influencing pre-operation baseline PVI

PVI: Pleth variability index; BMI: Body mass index. $n = 42$ for age ≥ 45 years old, $n = 25$ for age < 45 years old; $n = 37$ for male, $n = 30$ for female; $n = 26$ for BMI ≥ 24 kg/m², $n = 41$ for BMI < 24 kg/m². * $P < 0.05$. $\bar{x} \pm s$

PVI > 14% 区分是否对容量治疗有反应的敏感性为 81%, 特异性为 100%, 认为 PVI > 14% 提示容量不足, 可能需要对患者进行扩容治疗。蔡勤芳等^[5]连续监测 25 例腹部手术患者术中的 MAP、HR、CVP、心指数(CI)、每搏输出量变异度(SVV)、PVI 及 PI 等血流动力学指标, 将 CI 增加百分比 $\geq 15\%$ 视为对容量治疗有反应。结果显示, PVI 的诊断阈值为 15.5%, 监测容量反应的灵敏度为 88.2%, 特异度为 87.5%; 认为 PVI 能够预测机械通气患者在安静状态下的容量治疗反应, 其准确性与有创测得的 SVV 相类似。

本研究中患者入室 PVI 平均基础值为 (16.8 ± 6.3)%, 提示大部分患者术前需要给予补液治疗。

但是 PVI 升高不一定代表需要进行积极输液, 例如本研究中气腹建立后 PVI 显著上升, 但是主要是由于气腹后下腔静脉受压所致, 假如输液过多, 撤除气腹后反而加重心脏负担。本研究发现, 全麻诱导后患者 PVI 下降, 血压下降, 考虑诱导后血管扩张引起的外周血管灌注改善可能会降低脉搏灌注变异程度。日本东京大学的 Mizuno 等^[6]研究 21 名全麻择期手术患者发现: 麻醉诱导补液前后, 收缩压明显降低, 氧饱和度显著提高, PI 显著升高, PVI 显著降低。于是得出结论: 诱导后外周灌注改善, 容量状态和前负荷增加。其结论支持我们的推论。

最后, 本研究还发现年龄 < 45 岁和男性患者基础 PVI 值分别高于年龄 ≥ 45 岁和女性患者, 这可能提示年龄 < 45 岁和男性患者全麻手术过程需要预充更多的液体。这也为 PVI 指导临床术前补液提供了一定的依据。

4 利益冲突

所有作者声明本文不涉及任何利益冲突。

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