




Effect of different pneumoperitoneum pressure on stress state in patients underwent gynecological laparoscopy

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ABSTRACT

Objective: To observe the effect of different CO₂ pneumoperitoneum pressure on the stress state in patients underwent gynecological laparoscopy. **Methods:** A total of 90 patients who were admitted in our hospital from February, 2015 to October, 2015 for gynecological laparoscopy were included in the study and divided into groups A, B, and C according to different CO₂ pneumoperitoneum pressure. The changes of HR, BP, and PetCO₂ during the operation process in the three groups were recorded. The changes of stress indicators before operation (T₀), 30 min during operation (T₁), and 12 h after operation (T₂) were compared. **Results:** The difference of HR, BP, and PetCO₂ levels before operation among the three groups was not statistically significant ($P>0.05$). HR, BP, and PetCO₂ levels 30 min after pneumoperitoneum were significantly elevated when compared with before operation ($P<0.05$). HR, BP, and PetCO₂ levels 30 min after pneumoperitoneum in group C were significantly higher than those in groups A and B ($P<0.05$). The difference of HR, SBP, and DBP 30 min after pneumoperitoneum between group A and B was not statistically significant ($P>0.05$). PetCO₂ level 30 min after pneumoperitoneum in group B was significantly higher than that in group A ($P<0.05$). The serum COR, NE, and PGE₂ levels in the three groups at T₁ were significantly elevated ($P<0.05$). The serum COR, NE, and PGE₂ levels in group C were significantly higher than those in groups A and B ($P<0.05$). The serum COR, NE, and PGE₂ levels in the three groups at T₂ were gradually elevated, but the difference among the groups was not statistically significant ($P>0.05$). **Conclusions:** Low pneumoperitoneum pressure has a small effect on the stress state in patients underwent gynecological laparoscopy, will not affect the surgical operation, and can obtain a preferable muscular relaxation and vision field; therefore, it can be selected in preference.

1. Introduction

The laparoscopy is a minimally invasive surgery, has advantages of small incision and trauma, and rapid postoperative recovery, and has been widely applied in the clinical surgery, obstetrics and gynecology[1]. Pneumoperitoneum is one of the important premise for obtaining the clear nerves and operating space during the laparoscopic operation, but during the operation, the elevated intra-abdominal pressure due to CO₂ can change the stress, which will

increase the operation risk[2]. Some researches demonstrate that[3-5] different pneumoperitoneum pressure can cause a certain effect on the physiological function. The study is aimed to observe the effect of different CO₂ pneumoperitoneum pressure on the stress state in patients underwent gynecological laparoscopy.

2. Materials and methods

2.1. Clinical materials

A total of 90 patients who were admitted in our hospital from February, 2015 to October, 2015 for gynecological laparoscopy were

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included in the study, aged from 21 to 55 years old, with an average age of (41.6±2.3) years old; average body weight of (58.4±7.1) kg; grade ASA I-II. All the patients were confirmed with hysteromyoma before operation, and hysteromyoma resection was required. Those who had severe vital organic dysfunction and abnormal laboratory examinations results were excluded from the study.

2.2. Methods

A total of 90 patients were divided into group A (11 mmHg), group B (13 mmHg), and group C (15 mmHg) with 30 cases in each group according to different CO₂ pneumoperitoneum pressure. A general anesthesia was performed. After entering the operating room, the vital signs were monitored, and the venous channel was established. After a satisfactory anesthesia, routine disinfection and towel spreading were performed. The vagina and cervix were disinfected and the uterine manipulator was placed. A longitudinal incision with a length of about 1 cm was made on the superior border of navel. A Veress needle was inserted, and CO₂ was filled. The above 3 pneumoperitoneum pressure was maintained. The pneumoperitoneum pressure was controlled by the pneumoperitoneum apparatus. The pneumoperitoneum pressure was maintained as possible during operation. The gas was fully discharged after operation. A successful operation was performed in the three groups.

2.3. Observation indicators

The changes of HR, BP, and PetCO₂ during the operation process in the three groups were recorded. The venous blood before operation (T₀), 30 min after pneumoperitoneum (T₁), and 12 h after operation (T₂) was collected. ELISA was used to detect the serum COR, NE, and PGE₂ levels.

2.4. Statistical analysis

SPSS 13.0 software was used for the statistical analysis. Data were expressed as mean±SD. Student-Newman-Keuls test and ANOVA were applied. $P<0.05$ was regarded as statistically significant difference.

3. Results

3.1. Comparison of vital signs indicators at each timing point and the operation time among three groups

The difference in operation time among the three groups was not statistically significant ($P>0.05$). The difference of HR, BP, and PetCO₂ levels before operation among the three groups was not statistically significant ($P>0.05$). HR, BP, and PetCO₂ levels 30 min after pneumoperitoneum were significantly elevated when compared with before operation ($P<0.05$). HR, BP, and PetCO₂ levels 30 min after pneumoperitoneum in group C were significantly higher than those in groups A and B ($P<0.05$). The difference of HR, SBP, and DBP 30 min after pneumoperitoneum between group A and B was not statistically significant ($P>0.05$). PetCO₂ level 30 min after pneumoperitoneum in group B was significantly higher than that in group A ($P<0.05$) (Table 1).

3.2. Comparison of stress indicators at each timing point among three groups

The serum COR, NE, and PGE₂ levels in the three groups at T₁ were significantly elevated ($P<0.05$). The serum COR, NE, and PGE₂ levels in group C were significantly higher than those in groups A and B ($P<0.05$). The serum COR, NE, and PGE₂ levels in the three groups at T₂ were gradually elevated, but the difference among the groups was not statistically significant ($P>0.05$) (Table 2).

Table 2

Comparison of stress indicators at each timing point among three groups.

Groups	n		COR (μg/dL)	NE (pg/mL)	PGE ₂ (pg/mL)
Group A	30	T ₀	17.09±3.76	250.66±22.52	45.84±3.22
		T ₁	34.20±4.16 [*]	254.60±23.84 [*]	46.14±3.82 [*]
		T ₂	42.39±3.52 [*]	255.82±25.59 [*]	45.63±3.20 [*]
Group B	30	T ₀	17.42±2.06	284.82±21.70	102.71±16.05
		T ₁	34.99±4.38 [*]	340.54±23.05 [*]	127.88±16.61 ^{##}
		T ₂	42.81±4.57 [*]	420.42±19.64 [*]	157.01±22.93 ^{##}
Group C	30	T ₀	17.27±2.23	289.61±20.39	99.39±14.95
		T ₁	40.28±5.57 ^{##}	422.38±18.49 ^{##}	115.62±15.33 ^{##△}
		T ₂	49.75±3.64 ^{##}	482.91±15.12 ^{##}	159.01±16.65 ^{##△}

^{*} $P<0.05$, when compared with before operation; [△] $P<0.05$, when compared with group A; ^{##} $P<0.05$, when compared with group B.

Table 1

Comparison of vital signs indicators at each timing point among three groups.

Groups	n		HR (times/min)	Blood pressure (mmHg)		PetCO ₂
				SBP	DBP	
Group A	30	Before operation	75.70±8.10	117.40±9.70	68.80±6.30	4.24±0.18
		30 min after pneumoperitoneum	85.30±8.40 [*]	124.10±10.20 [*]	74.00±5.70 [*]	5.27±0.16 [*]
Group B	30	Before operation	75.39±9.20	116.30±11.00	69.00±7.40	4.23±0.19
		30 min after pneumoperitoneum	84.99±9.70 [*]	124.89±9.70 [*]	74.59±4.70 [*]	5.75±0.14 [△]
Group C	30	Before operation	75.80±8.70	120.20±20.30	69.40±8.00	4.23±0.16
		30 min after pneumoperitoneum	91.59±8.20 ^{##}	130.44±9.20 ^{##}	77.34±6.50 ^{##}	6.24±0.15 ^{##}

^{*} $P<0.05$, when compared with before operation; [△] $P<0.05$, when compared with group A; ^{##} $P<0.05$, when compared with groups A and B.

4. Discussion

The laparoscopy is gradually applied in the clinic in the early 20 s, and has been widely accepted by massive patients due to its advantages of small trauma, mild postoperative pain, and rapid recovery[6]. The laparoscopic operation is a minimally invasive surgery, and clear surgical fields are required during operation, while CO₂ is an ideal medium for pneumoperitoneum of laparoscopic operation[7]. Some researches demonstrate that[8-11] different pneumoperitoneum pressure can cause a certain effect on the stress reaction during the process of laparoscopic operation. Therefore, in the study, observation on the effect of different pneumoperitoneum pressure on the stress reaction is aimed to provide an evidence for the selection of pneumoperitoneum pressure during operation.

Some scholars argue that[12] during the process of laparoscopic operation, the hypercapnia and intra-abdominal high pressure syndrome caused by CO₂, and the ischemia reperfusion injury caused by the reduced intra-abdominal pressure after operation are the main reasons for inducing the stress reaction. The stronger the action is, the more severe the stress reaction is. After establishing CO₂ pneumoperitoneum, the intra-abdominal pressure is suddenly raised, and the diaphragm is lifted, which can squeeze the thoracic cavity space, resulting in reduced FRC and lung function, while when the pneumoperitoneum pressure is relatively low, the patients' respiratory function is relatively stable[13,14]. The results in the study showed that PetCO₂ level 30 min after pneumoperitoneum in group B and C was significantly higher than that in group A ($P<0.05$); moreover, HR and BP 30 min after pneumoperitoneum in group C were significantly higher than those in group A and B ($P<0.05$), proving that the low pneumoperitoneum pressure has a small effect on the respiratory and circulatory function. The stress is mainly caused by sympathetic nerve-adrenal medulla pathway, hypothalamus- pituitary gland-gland pathway, and monocyte-macrophage system pathway[15,16]; therefore, COR, NE, and PGE₂ with high representativeness are selected in the study for observation. The results in the study showed that the serum COR, NE, and PGE₂ levels in the three groups at T₁ were significantly elevated ($P<0.05$); the serum COR, NE, and PGE₂ levels in group C were significantly higher than those in groups A and B ($P<0.05$); the serum COR, NE, and PGE₂ levels in the three groups at T₂ were gradually elevated, but the difference among the groups was not statistically significant ($P>0.05$), indicating that during the laparoscopic operation, reduction of pneumoperitoneum pressure can alleviate the stress reaction, and contribute to the stability of vital signs and internal environment during operation.

In conclusion, low pneumoperitoneum pressure has a small effect on the stress state in patients underwent gynecological laparoscopy, will not affect the surgical operation, and can obtain a preferable muscular relaxation and vision field; therefore, it can be selected in preference.

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