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Original Article

Comparison of the clinical effect of different anesthetic methods in gynecological laparoscopic operation

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Abstract: Objective: To observe and compare the clinical effect of different anesthesia methods in gynecologic laparoscopic surgery. Methods: 312 patients undergoing laparoscopic surgery during January 2012 and October 2015 were randomly divided into group A (combined spinal-epidural anesthesia, n=156) and group B (combined intravenous anesthesia, n=156). By continuous monitoring method, blood oxygen saturation (SpO_2), respiration (R), heart rate (HR), mean arterial pressure (MAP) and other hemodynamic parameters were monitored at pre-anesthesia, 10 min after surgery began and 10 min post-operation, respectively; arterial blood gas of patients were examined at pre-anesthesia, 15 min after pneumoperitoneum and 10 min post-operation; and the postoperative complication incidence as well as the satisfaction rates toward anesthesia were statistically analyzed. Results: There were no significant differences in pre-anesthesia parameters such as SpO_2, R, HR, MAP between two groups; for group A, the values of HR, R and MAP at 15 min intra-operation were significantly lower than those of pre-anesthesia ($P < 0.05$), the values returned to pre-anesthesia levels at 10 min post-operation; but for group B, there was no significant changes in indices of SpO_2, R, HR and MAP comparing with pre-anesthesia value ($P > 0.05$). At 15 min after pneumoperitoneum in group A, oxygen partial pressure (PaO_2) and pH value were significantly decreased compared with those of pre-anesthesia, while partial pressure of carbon dioxide ($PaCO_2$) values were significantly increased ($P < 0.05$). $PaCO_2$ values at 10 min after pneumoperitoneum of Group B was significantly lower than that of Group A, although the value was remarkably increased comparing to its pre-anesthesia value; while PaO_2 value was significantly lower than its pre-anesthesia value, but significantly higher than that of group A, and the difference was statistically significant ($P < 0.05$). The incidence of complications in group B was lower than that in group A, and patients in Group B had higher satisfaction rate in anesthesia effect than patients in group A, the difference was statistically significant ($P < 0.05$). Conclusions: Both combined spinal-epidural anesthesia and intravenous combined anesthesia can be used for gynecological laparoscopic surgery; however, comparing to combined spinal epidural anesthesia, intravenous anesthesia has less impact on respiration and circulation, and it is more worthy to be promoted in clinical practice with better effect and higher safety.

Keywords: Combined spinal epidural anesthesia, intravenous anesthesia, laparoscopic surgery, blood gas analysis

Introduction

Recently, laparoscopic surgery has been frequently applied to the diagnosis and operation in gynecology due to its small environmental interference, less trauma, faster recovery and shorter hospital stay; according to statistics, about 35%-75% of pelvic surgery adopted laparoscopic surgery [1]. Combined spinal-epidural anesthesia and intravenous combined anesthesia are two mostly used methods for local anesthesia in clinical practice of laparoscopic surgery [2]. There are many kinds of anesthesia methods used in gynecological surgery, the most commonly used are general anesthesia, combined spinal-epidural anesthesia and intravenous anesthesia; different anesthesia methods have their own characteristics in the application, there are many studies on the application effect of general anesthesia and combined spinal-epidural anesthesia in gynecologic laparoscopic surgery, and the results are diverse.

Table 1. Comparison of the general condition of patients in group A and group B

Group	Case	Age ($\bar{X}$±S)	Height ($\bar{X}$±S)	Weight ($\bar{X}$±S)	Anesthesia time ($\bar{X}$±S)	ASA rating (case)	
						i	ii
Group A	156	33.29±3.01	164.21±2.41	50.88±12.89	117.41±27.49	71	85
Group B	156	33.58±2.41	164.53±3.11	51.21±11.62	115.91±28.51	79	77

Note: group A with combined spinal-epidural anesthesia; group B with intravenous combined anesthesia.

Gynecologic laparoscopic surgery has high requirement for anesthesia, and it is mainly related with the high standard in anesthesia level [3]. Traditional gynecological surgery is abdominal incision and pelvic surgery with a general anesthetic plane of T8-S1, which can meet the needs of clinical surgery. However, the physiological impact caused by Trendelenburg position in laparoscopic surgery and artificial pneumoperitoneum has brought difficulties in the management of anesthesia. Abdominal pressure elevation and diaphragm uplift after implementation of CO_2 pneumoperitoneum in laparoscopic surgery will directly stimulate the diaphragmatic surface, and cause radioactive pain in the shoulder and arm; the level of anesthesia should reach T4. Although combined spinal-epidural anesthesia will bring greater volatility to circulation, and the hemodynamic will be affected by CO_2 pneumoperitoneum and surgical position, patients with normal cardiopulmonary function can still capable of compensation. There is certain accumulation of CO_2 and hypercapnia after pneumoperitoneum; since patients are conscious and capable of spontaneous respiratory, they can automatically increase the respiratory rate and tidal volume, thus CO_2 in blood could be quickly exhaled through alveolar gas exchange, to a certain extent, this can reduce CO_2 accumulation [4]. Based on above situation, we observed and compared the clinical efficacy of different anesthesia methods, by comparing the circulation, respiration, blood gas change, complications as well as the satisfaction rate, to explore a more appropriate and safe anesthesia method for gynecologic laparoscopic surgery, the reports are as follow.

Material and methods

General information

312 patients undergoing laparoscopic surgery in our hospital from January 2012 to October 2015 were selected as the research object in this study. The patients aged 34-54 years old with height of 151-183 cm and weight of 45-80 kg, and the ASA grade was I-II. The 312 cases of patients were randomly divided into group A and group B with 156 cases each. There were 30 cases of acute pelvic inflammatory disease, 41 cases of uterine fibroids, 26 cases of ectopic pregnancy and 59 cases of abdominal cysts in group A; all patients were confirmed by abdominal B ultrasound, CT and other examination methods and treated by combined spinal-epidural anesthesia; there were 32 cases of acute pelvic inflammatory disease, 47 cases of uterine fibroids, 28 cases of ectopic pregnancy, and 49 cases abdominal cysts in group B, after confirmed by abdomen B ultrasound and CT, patients in group B were local anesthetized by intravenous combined anesthesia. This study was approved by the ethics committee of our hospital, and informed consent was obtained before the laparoscopic surgery from all patients. There was no significant difference in the condition, weight, age, operation time and operation type between the two groups ($P > 0.05$). The two groups were comparable, see **Table 1**.

Anesthetic processing method

Patients in both groups A and B were routinely intramuscular injected of atropine 0.5-0.7 mg and diazepam 10-14 mg at 30-40 min before anesthesia, the actual administration volume of the drug was different based on the individual differences, but the difference was not significant and within the allowable range of operation administration. After entering the operation room, upper limb vein was opened in two groups. Patients in group A took left lateral position, on the basis of successful puncture in the gap of L3-4, 3~6 ml isobaric 0.375% bupivacaine was infused; the level of anesthesia was controlled at T6 level, and there was no intravenous administration of drugs during surgical procedures. Patients in group B were induced and endotracheal intubated by giving 1 ug/kg remifentanil and 2 mg/kg propofol in turn; the breathing rate and depth of patients

Table 2. Comparison of changes in respiration and circulation of patients in group A and group B ($\bar{X}$ ±S)

Group	Case	Time	Breath (/min)	Heart rate (/min)	Mean arterial pressure (mmHg)	Oxygen saturation (%)
Group A		Pre-anesthesia	75.21±1.02	20.09±2.01	90.72±9.32	99.03±0.21
		15 minutes intra-operation	59.22±2.15#	14.45±1.98#	68.42±9.21#	99.17±0.63
		10 minutes post-operation	75.61±1.97	20.87±1.21	92.41±6.31	99.04±0.54
Group B		Pre-anesthesia	74.94±1.03	20.71±2.11	91.48±8.31	99.03±0.47
		15 minutes intra-operation	75.42±1.08	20.12±2.31	90.48±7.08	99.02±0.21
		10 minutes post-operation	75.89±1.01	20.84±2.04	93.02±7.47	99.02±041

Note: group A with combined spinal-epidural anesthesia, group B with intravenous combined anesthesia; #P < 0.05, comparing to their own pre-anesthesia values of group A and group B, respectively.

were controlled, and then sevoflurane (0.5%~4.5%) was inhaled by patients according to their condition, and then 3~4 mg/(kg h) propofol was intermittently pumped into patients. Specific respiratory control of patients: tidal volume was controlled at 8~11 ml/kg, respiratory frequency was controlled at 13-17 times/min, and properly increase respiratory frequency and tidal volume after pneumoperitoneum.

Observation index during operation

After entering the operating room, heart rate (HR), respiration (R), mean arterial pressure (MAP) and oxygen saturation (SpO_2) of patients were monitored using ECG monitor; the data were objectively and accurately recorded at pre-anesthesia, 15 min after surgery began and 10 min post-operation. The radial artery blood was collected to detect the changes in blood gas at three different time points: pre-anesthesia, 15 min after establishing pneumoperitoneum, and 10 min post-operatioin.

Complications and patient satisfaction survey

The intra-operative and post-operative complications of patients in both group A and B were recorded, and the patients' satisfaction toward operation were collected in the form of questionnaire. Likert Scale (3-grade) was used to evaluate the satisfaction level; 1 point for never satisfied, 2 points for occasionally satisfied, and 3 points for always satisfied.

Statistics processing

SPSS 19.0 was used to carry on statistical process. The measurement data were expressed by mean ± standard deviation ($\bar{X}$ ±S) and tested by t, enumeration data were examined by χ^2 test; the level of a test was α=0.05 and $P < 0.05$ was considered with significant difference.

Results

Changes in respiration and circulation of patients in group A and group B

SpO_2, HR, MAP, R and other indices were compared between group A and B before anesthesia, and the results showed no significant difference (P > 0.05). At 15 minutes after surgery began, the blood gas indices such as HR, R and MAP in group A were significantly decreased, compared with its pre-anesthesia values, and the difference was statistically significant (P < 0.05), then the values dropped to the range of pre-anesthesia in 10 min after surgery. Comparing with pre-anesthesia value, the HR, R, MAP and other blood gas indicators in group B didn't change so much at 15 min intra-operation and 10 min post-operation, the difference was not statistically significant (P > 0.05), see **Table 2**.

Changes in arterial blood gas of patients in group A and group B

10 minutes after the establishment of pneumoperitoneum, the changes in arterial blood gas were compared between group A and group B. The results showed that the pH value and PaO_2 of group A was significantly lower than pre-anesthesia, while $PaCO_2$ value was significantly higher than pre-anesthesia, the differences were statistically significant (P < 0.05). Comparing with per-anesthesia value, there was no significant change in the pH value of patients in Group B at 10 min after establishment of pneumoperitoneum (P > 0.05); however, the PaO_2

Table 3. Comparison of changes in arterial blood gas of patients in group A and group B ($\bar{X}$±S)

Group	Case	Time	PH	PaO_2 (mmHg)	$PaCO_2$ (mmHg)
Group A	150	Pre-anesthesia	7.34±0.11	98.12±0.02	40.01±0.82
		15 minutes intra-operation	7.30±0.07#,*	82.02±0.62#,*	54.08±1.68#,*
		10 minutes post-operation	7.36±0.14	99.14±0.12	40.41±0.11
Group B	150	Pre-anesthesia	7.41±0.03	99.02±0.07	40.32±0.13
		15 minutes intra-operation	7.39±0.05	94.21±0.01#	45.31±1.82#
		10 minutes post-operation	7.36±0.08	98.83±0.04	40.01±0.52

Note: group A with combined spinal-epidural anesthesia, group B with intravenous combined anesthesia; #P < 0.05, comparing to their own pre-anesthesia values of group A and group B, respectively; *P < 0.05, comparing to group B at the same time interval.

Table 4. Comparison of blood loss, infusion volume and the occurrence of DVT in patients of group A and group B

Group	Amount of blood loss (ml)	Infusion volume (ml)	DVT occurrence rate (%)
Group A (156)	151.21±52.89	1025.34±102.21	12 (7.6)
Group B (156)	153.58±53.51	1021.38±101.87	14 (8.9)

Table 5. The comparison of postoperative complications of patients in group A and group B

Group	Complications (cases (%))		
	Nausea	Vomit	Others
Group A	9 (6)	6 (4)	4 (2)
Group B	3 (2)	0 (0)	5 (3)

Table 6. Comparison of the satisfaction rate toward anesthesia in patients of group A and group B (cases (%))

Group	Patient satisfaction		
	Always satisfied	Occasionally satisfied	Never satisfied
Group A	100 (64)	44 (16)	0 (0)
Group B	131 (84)	25 (28)	12 (8)

value decreased by comparing with pre-anesthesia, but it was significantly higher than that of group A at the same time period (P < 0.05); and the $PaCO_2$ value increased by comparing with pre-anesthesia, but it was significantly lower than that group A at the same time period, the difference was statistically significant (P < 0.05). See **Table 3**.

Comparison of blood loss, infusion volume and DVT in patients of group A and group B

The results of this study showed that there was no significant difference in blood loss and infusion volume between group A and group B (P > 0.05). The occurrence of deep vein thrombosis (DVT) in Group A and Group B was compared and the result showed that there was no significant difference between the two groups (P > 0.05). See **Table 4**.

Comparison of the incidence of postoperative complications and satisfaction rate in patients of group A and group B

The incidence of postoperative complications and satisfaction rate on anesthesia was compared between patients in group A and group B, and the results showed that the incidence of complications such as nausea and vomiting in group A was higher than that of group B, as shown in **Table 5**. In addition, the satisfaction rate on anesthesia (always satisfied + occasionally satisfied) in group B was higher than that of group A, and the difference was statistically significant (P < 0.05), as shown in **Table 6**.

Discussion

Laparoscopy, with minimal invasion, has gradually developed into a mature method of diagnosis and treatment and widely used in gynecological surgery in recent years [5]. In clinical practice, most of the laparoscopic operation use 2~4 hole method and one of holes is on the umbilicus, which can effectively avoid a long scar on the abdominal part of the patient, and reduce the mental pressure and physical pain as well as surgical injury on patient; the recovery period was also significantly shortened, moreover, the impact of laparoscopic surgery on the basic vital signs and function of the patients was also reduced [6-9]. However, the traction caused by laparoscopic surgery and

the lesion excision inside uterine cavity as well as the dilation of cervix will causes the pain on patients, and lead to the excitement of vagus nerve; clinically, patients are easily to show complications like induced abortion syndrome. Therefore, how to effectively ensure anodynia for patients is particularly important in the process of laparoscopic gynecologic surgery [10-12]. If a safe and effective anesthesia method, which has little impact on the physical condition of patients, could be applied in the gynecologic laparoscopic surgery, we can further minimize the surgical impact on patients and achieve an ideal optimization of surgery. Clinically, the arguments on anesthesia method in gynecological laparoscopic surgery never stopped [13-16]. At present, the commonly used methods are combined spinal-epidural anesthesia and intravenous combined anesthesia; there are many studies on the effect of anesthesia in gynecological laparoscopic surgery, but the results are inconsistent. And a number of studies have indicated that gynecological laparoscopic surgery has strict requirements on anesthesia, mainly related with the high requirements on anesthetic plane [17, 18].

The main purpose of this study was to observe and compare the clinical effects of different anesthesia methods in gynecological laparoscopic surgery. 312 patients in our hospital were randomly divided into group A (combined spinal epidural anesthesia) and group B (intravenous combined anesthesia). By continuous monitoring method, we observed hemodynamic parameters of SpO_2, R, HR and MAP at pre-anesthesia, 15 min intra-operation, and 10 min post-operation, respectively; we also observed and examined the arterial blood gas of patients at pre-anesthesia, 15 minutes after pneumoperitoneum, and 10 min post-operation, and recorded and analyzed the incidence of postoperative complications and the satisfaction rates toward anesthesia. The results showed that intravenous combined anesthesia in gynecologic laparoscopic surgery had a better application effect in the aspects like MAP, SpO_2 and HR, comparing to combined spinal-epidural anesthesia; comparing with pre-anesthesia, the arterial blood pressure of patients in group B didn't change great, and restored to pre-anesthesia level in 10 min after surgery; arterial pressure fluctuation was steady throughout the whole procedure. Comparing with group A, the fluctuation of SpO_2 and HR in group B was steadier during operation, the patients in group B had less fluctuations in vital signs and more stable in basic physiological indicators. 15 min after pneumoperitoneum, PaO_2 and pH was significantly decreased while $PaCO_2$ was remarkably increased in group A, comparing with pre-anesthesia. $PaCO_2$ value in group B was remarkably increased at 10 min after pneumoperitoneum, however, the $PaCO_2$ level was lower than the value of group A at the same period; and PaO_2 value in group B was significantly reduced at 10 min after pneumoperitoneum but still significantly higher than the value of group A at the same time; the differences were statistically significant. Thus, intravenous combined anesthesia didn't have great impact on the changes in blood gas. We also analyzed the adverse reactions, post-operative complications and satisfaction rate in both group A and group B after anesthesia, and the results showed that there was no serious complications occurred in both groups, the overall safety was accepted; however, patients in group B had less nausea, vomiting and other adverse complications; therefore, intravenous combined anesthesia can remarkably reduce the incidence of adverse reactions, in addition, with its simpler management and higher satisfaction rate, intravenous combined anesthesia is widely accepted by medical staff and more suitable for promotion in clinical practice. This is consistent with the results of the studies from abroad; therefore, intravenous combined anesthesia is more feasible in gynecologic laparoscopic surgery [19-21].

In summary, intravenous combined anesthesia in gynecologic laparoscopic surgery has better surgical effect and less impact on the vital signs of patients; it is widely accepted by patients and more suitable for widely promoted in clinic.

Disclosure of conflict of interest

None.

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