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Original Article

Comparative effects on three anesthesia methods in gynecologic laparoscopic surgery

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Abstract: Objective: To investigate the clinical outcomes of three anesthesia methods in gynecologic laparoscopic surgery. Methods: 300 patients performed gynecologic laparoscopic surgery from January, 2014 to January, 2016 in this hospital were divided into 3 groups by random number method as general anesthesia group, continuous epidural anesthesia group and general anesthesia combined with continuous epidural anesthesia group, with 100 cases in each group. Anesthesia effects of three groups and the changes of oxygen saturation (SpO2), heart rate (HR), mean arterial pressure (MAP) in different time orders (before pneumoperitoneum, 10 min after pneumoperitoneum and 10 min after deflation) were compared, and three groups' adverse reactions, analgesia, muscle relaxation and patients' anesthetic satisfaction were observed and recorded. Results: Compared with general anesthesia group and continuous epidural anesthesia group, general anesthesia combined with continuous epidural anesthesia group had obvious advantages in anesthesia effect, hemodynamic variables and patients' satisfaction, besides, the adverse reaction rate in this group decreased significantly, and the differences had a statistical significance ($P<0.05$). Meanwhile, in general anesthesia combined with continuous epidural anesthesia group, all patients' analgesia was excellent, and they were all satisfied with the effects of muscle relaxation. Conclusion: General anesthesia combined with continuous epidural anesthesia has a good effect on gynecologic laparoscopic surgery, with a low occurrence of adverse reactions, high safety and a little impact of respiration and circulation, which is worth to promote clinical applications in gynecologic laparoscopic surgery.

Keywords: General anesthesia, continuous epidural anesthesia, gynecologic surgery, laparoscopes, effect

Introduction

These days gynecologic laparoscopic surgery has been widely used, and the anesthesia method is the key to ensure that the operation can be successful [1, 2]. CO_2 artificial pneumoperitoneum and changes of position in the process of anesthesia for gynecologic laparoscopic surgery have a certain influence on respiration and circulation [3, 4]. Therefore, gynecologic laparoscopic surgery has certain requirements to the choice of anesthesia method. At present, anesthesia methods like general anesthesia, continuous epidural anesthesia general anesthesia combined with continuous epidural anesthesia have been used in gynecologic laparoscopic surgery. Gynecologic laparoscopic surgery has a high requirement for continuous epidural anesthesia. Only when block range of anesthesia level reaches up to T8-S1 can the need for operation meet. However, physiological effects caused by special vitro position and artificial pneumoperitoneum in laparoscopic surgery have raised difficulties in anesthesia management. With the obvious decrease of operation time, balanced anesthesia combined with endotracheal intubation has become more and more popular. However, which anesthesia method in gynecologic laparoscopic surgery is safer and more efficient should be studied further.

To investigate the best anesthesia method in gynecologic laparoscopic surgery, this research compared the different effects of three anesthesia methods by respectively applying general anesthesia, continuous epidural anesthesia and general anesthesia combined with continuous epidural anesthesia on 300 patients who would perform gynecologic laparoscopic

surgery from Jan. 2014 to Jan. 2016 in our hospital. The results of this study would provide evidence for guiding anesthesia method in gynecologic laparoscopic surgery.

Materials and methods

General materials

This study selected 300 cases of gynecologic patients who were performed with gynecologic surgery in our hospital from January 2014 to January 2016. According to the random number method, the 300 patients were divided into general anesthesia group, continuous epidural anesthesia group and general anesthesia combined with continuous epidural anesthesia group, in which each group had 100 gynecologic patients. In the general anesthesia group, patients' mean age was 34.21 ± 5.25; body mass index (BMI) was 23.5 kg/m^2; ASA I status had 55 cases and ASA II status had 45 cases; there were 48 cases of myomectomy, 36 cases of ectopic pregnancy and 16 cases of ovarian cyst resection. In the continuous epidural anesthesia group, patients' mean age was 35.16 ± 4.13; body mass index (BMI) was 24.1 kg/m^2; there were 50 cases of myomectomy, 35 cases of ectopic pregnancy and 15 cases of ovarian cyst resection; ASA I status had 52 cases and ASA II status had 48 cases. In the general anesthesia combined with continuous epidural anesthesia group, patients' mean age was 34.86 ± 4.53; body mass index (BMI) was 23.8 kg/m^2; there were 47 cases of myomectomy, 34 cases of ectopic pregnancy and 19 cases of ovarian cyst resection; ASA I status had 53 cases and ASA II status had 47 cases. All patients in the study were checked and diagnosed by abdominal B ultrasound, CT, MRI and so on. This study has gained approval from ethics committee and patients or their families had signed the informed consent before the operation. There were no significant differences between these three groups in terms of age, BMI index, disease type or ASA classification (P>0.05), the patients in three groups were comparable, as shown in **Table 1**.

Anesthetic treatment methods

The patients in each group were carried out with intramuscular injection of atropine (0.5-0.7 mg) and diazepam (10 mg) within 30 minutes before anesthesia. The patients' vital signs, such as heart rate, pulse, blood pressure, oxygen saturation, etc., were closely monitored and their venous access of the upper limb was opened. Patients in continuous epidural anesthesia group underwent left lateral decubitus, and they were punctured in the lumbar 3, 4 gap positioning, then injected into 5 ml lidocaine, taken another injection of 3~6 ml lidocaine (0.375%) on the basis of no symptoms of spinal anesthesia. Control the anesthesia level to the sixth thoracic vertebra level, intravenous pharmacy was not given during laparoscopic surgery. The patients in general anesthesia group were successively given 1 μg/kg remifentanil and 2 mg/kg propofol, to induce tracheal intubation and control patient's respiratory rate and respiratory depth, then the patients were required to inhale 0.5-4.5% sevoflurane, meanwhile pumped into 3 mg/kg·h propofol and then connected with anesthetic machine. Patients in general anesthesia combined with continuous epidural anesthesia group were given general anesthesia simultaneously on the basis of epidural anesthesia.

Observation index

The patients' indexes were monitored, such as heart rate (HR), respiration (R), mean arterial pressure (MAP), blood oxygen saturation (SpO2), etc. They were recorded respectively in three progresses, namely 10 minutes before pneumoperitoneum, 10 minutes after pneumoperitoneum and 10 minutes after deflation. Anesthesia effects (onset time, completely blocking time and awake time) were observed. The adverse reactions of each group were also recorded (nausea and vomiting, dizzy and ache). Patient's degrees of satisfaction with surgery were collected in the form of questionnaire, in which the score level adopted likert3 rating scale, and the degrees of satisfaction increased with the score. 1 score referred to dissatisfaction, 2 score referred to basic satisfaction while 3 score referred to complete satisfaction. Compare analgesic effects and abdominal muscle relaxation in each group, the criteria to determine abdominal muscle relaxation is as follows: poor: large muscle tonus, which may affect the operation; general: slight muscle tonus, which won't affect the operation; satisfaction: no muscle tonus. As for the criteria of analgesic effects: severe pain, which needs assisting in sedation and analge-

Table 1. Comparison of the basic data in three groups of patients with gynecologic laparoscopic surgery ($\bar{X} \pm S$)

Group	Case	Age (years old)	BM (kg/m^2)	ASA rating scalen (case)		The type of disease (case) Uterine myoma/ectopic pregnancy/ovarian cyst
				I	II	
Continuous epidural anesthesia group	100	35.16 ± 4.13	24.1	52	48	50/35/15
General anesthesia group	100	34.21 ± 5.25	23.5	55	45	48/36/16
General anesthesia combined with continuous epidural anesthesia group	100	34.86 ± 4.53	23.8	53	47	47/34/19

Table 2. Comparison of breathing, circulation index of three groups of patients ($\bar{X} \pm S$)

Group	Case	Time	Heart rate (/min)	Mean arterial pressure (mmHg)	Oxygen saturation (%)
General anesthesia group	100	Before pneumoperitoneum	74.21 ± 1.02	70.42 ± 2.42	99.05 ± 0.12
		10 min after pneumoperitoneum	73.22 ± 2.27	73.22 ± 4.11	99.34 ± 0.46
		10 min after deflation	75.57 ± 1.97	72.41 ± 4.43	99.24 ± 0.14
Continuous epidural anesthesia group	100	Before pneumoperitoneum	72.51 ± 3.53	71.67 ± 3.71	99.13 ± 0.72
		10 min after pneumoperitoneum	85.21 ± 6.41	70.39 ± 4.21	99.42 ± 0.81
		10 min after deflation	84.52 ± 3.81	73.02 ± 3.54	99.24 ± 064
General anesthesia combined with continuous epidural anesthesia group	100	Before pneumoperitoneum	73.82 ± 3.18	74.72 ± 4.32	99.33 ± 0.12
		10 min after pneumoperitoneum	64.22 ± 4.09*	65.42 ± 3.11*	99.44 ± 0.54
		10 min after deflation	63.65 ± 3.19*	62.41 ± 3.09*	99.54 ± 0.17

Note: *P<0.05 compared with pre-pneumoperitoneum.

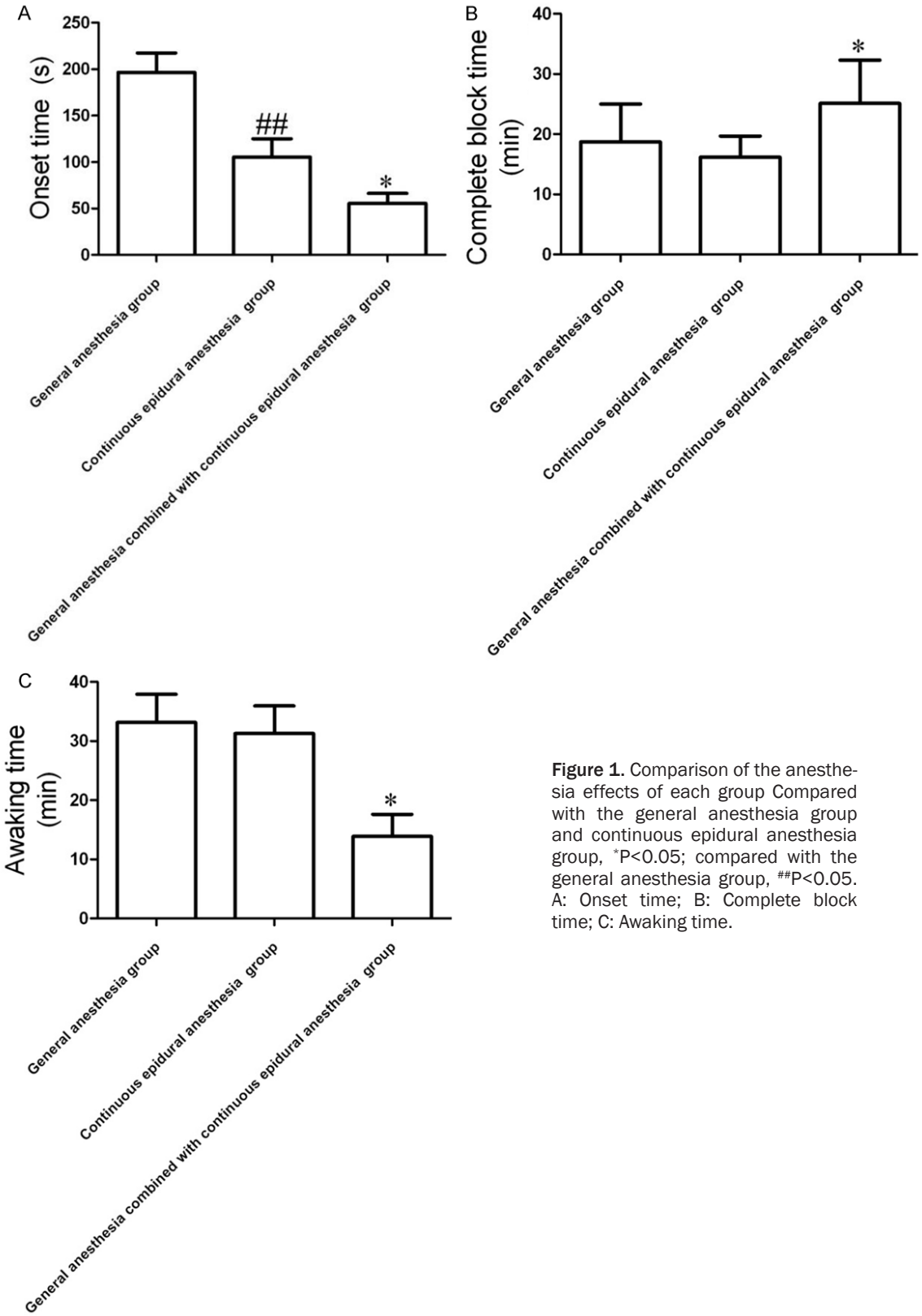

Figure 1. Comparison of the anesthesia effects of each group Compared with the general anesthesia group and continuous epidural anesthesia group, *P<0.05; compared with the general anesthesia group, ##P<0.05. A: Onset time; B: Complete block time; C: Awaking time.

sia means poor; mild pain, which needs assisting in sedation and analgesia means good; and if there is no need for sedation and analgesia means excellent.

Table 3. Comparison of adverse reactions of patients in each group

Group	Nausea and vomiting (case)	Dizzy (case)	Ache (case)
General anesthesia group	10	8	6
Continuous epidural anesthesia group	7	7	8
General anesthesia combined with continuous epidural anesthesia group	2	1	2

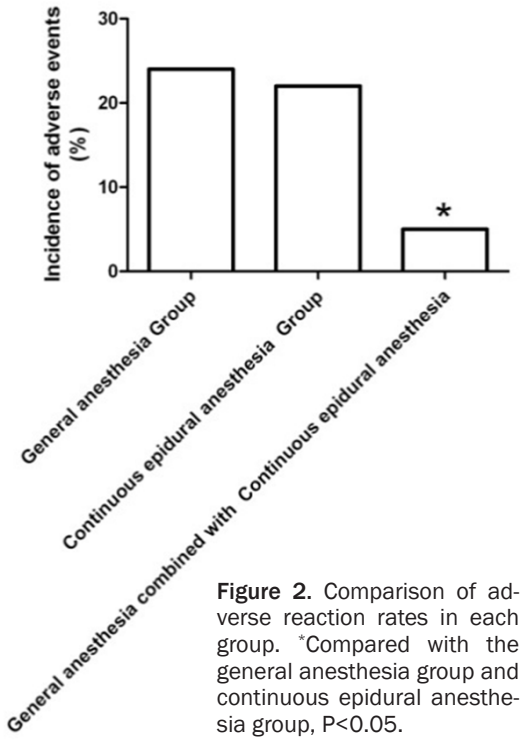

Figure 2. Comparison of adverse reaction rates in each group. *Compared with the general anesthesia group and continuous epidural anesthesia group, P<0.05.

Statistical treatment

SPSS 17.0 statistical analysis software was used for statistical analysis, the measurement data was shown by mean ± standard deviation (± s), one-factor analysis of variance was used for the comparison between the groups, χ^2 test was used for measurement data, and P<0.05 was considered as the statistics significance.

Results

Comparison of anesthetic effects among different groups of patients

The onset time of patients in general anesthesia combined with continuous epidural anesthesia group was 55.45 ± 10.87 s, the time of complete block was 25.12 ± 7.21 min and the time of regain consciousness was 13.87 ± 3.75 min. Compared with other two groups, the general anesthesia combined with continuous epidural anesthesia group had obvious advantages, and the difference was significant (P< 0.05). Compared with the general anesthesia group, the onset time of the continuous epidural anesthesia group was significantly shortened, which was statistically different (P<0.05), as shown in **Figure 1**.

Comparison of hemodynamics indexes among different groups of patients

The heart rate, mean arterial pressure, oxygen saturation and other circulatory and respiratory function monitoring indicators of patients in three groups before pneumoperitoneum, after pneumoperitoneum and after deflation can be seen in **Table 2**. There was no significant difference in blood oxygen saturation among the groups. There was no statistically significant difference in heart rate and mean arterial pressure between general anesthesia group and continuous epidural anesthesia group. However, the hemodynamic parameters of general anesthesia combined with continuous epidural anesthesia group was superior to other two groups, which was statistically different (P<0.05).

Comparison of adverse reactions among different groups of patients

The incidence of adverse reactions of patients in the general anesthesia combined with continuous epidural anesthesia group was significantly lower than other two groups, and the difference was statistically significant (P<0.05). However, there was no statistically significant difference in the incidence of adverse reactions between general anesthesia group and continuous epidural anesthesia group. See **Table 3** and **Figure 2**.

Comparison of satisfaction of anesthesia among different groups of patients

The degrees of satisfaction of anesthesia in the three groups were shown in **Table 4**. The satis-

Table 4. Comparison of satisfaction of anesthesia among the three groups

Groups	Satisfaction of patient		
	Satisfaction	Basic satisfaction	Dissatisfaction
General anesthesia group	86	10	4
Continuous epidural anesthesia group	68	20	12
General anesthesia combined with continuous epidural anesthesia group	92	8	0

Table 5. Comparison of the effects of muscle relaxation and analgesia among the three groups

Groups	The effects of muscle relaxation			The effects of analgesia		
	Satisfaction	Basic satisfaction	Dissatisfaction	Satisfaction	Basic satisfaction	Dissatisfaction
General anesthesia group	100	0	0	100	0	0
Continuous epidural anesthesia group	51	32	17	68	24	8
General anesthesia combined with continuous epidural anesthesia group	100	0	0	100	0	0

factory rate of patients in the general anesthesia group was 96%, and the satisfactory rates of patients in the continuous epidural anesthesia group and the general anesthesia combined with continuous epidural anesthesia group were 88% and 100%. Meanwhile, the difference of satisfaction between the general anesthesia combined with continuous epidural anesthesia group and the continuous epidural anesthesia group had statistical significance ($P<0.05$) as well as the difference between the general anesthesia group and the continuous epidural anesthesia group. However, the difference of satisfaction between the general anesthesia combined with continuous epidural anesthesia group and the general anesthesia group was inconspicuous.

Comparison of the effects of muscle relaxation and analgesia among different groups of patients

As for the effects of analgesia, the satisfactory rate in continuous epidural anesthesia group was 68%, while the basic satisfactory rate was 24% and the unsatisfactory rate was 8%. The satisfactory rates in the general anesthesia combined with continuous epidural anesthesia group and general anesthesia group were completely 100%. As for the effects of muscle relaxation, the satisfactory rate in continuous epidural anesthesia group was 51%, while the basic satisfactory rate was 32% and the unsatisfactory rate was 17%. Meanwhile, the satisfactory rates in general anesthesia combined with continuous epidural anesthesia group and general anesthesia group were all 100%, as shown in **Table 5**.

Discussion

Recently, laparoscopic surgery has developed into a mature minimally invasive diagnostic and therapeutic measure. Most gynecologic diseases can be cured with laparoscopic surgery. At the same time, this kind of therapy has several advantages, such as less surgery trauma, rapid postoperative recovery and so on [5]. During the gynecologic laparoscopic surgeries, the main problems we faced are obstructions on the pathophysiology of patients caused by the special position and the artificial carbon dioxide pneumoperitoneum [6]. Because the carbon dioxide pneumoperitoneum is able to leave a series of impacts on the respiration and circulation of patients, the risk of mild acidosis and hypercapnia may be increased in the surgery [7, 8]. However, if we take proper anesthesia methods which are safe, effective and have a little influence on the laparoscopic gynecologic surgeries, we will be able to decrease or even minimize the impacts on organisms and then achieve the optimal operation effect. The anesthesia method of laparoscopic gynecologic surgery is controversial in clinic at present [9, 10]. And plenty of researches indicated that the laparoscopic gynecologic surgery had a high expectation for the anesthesia methods [11]. Nowadays, general anesthesia combined with continuous epidural anesthesia, general anesthesia and continuous epidural anesthesia are three commonly used anesthesia methods.

Although there were many researches on the effects of those anesthesia methods in the laparoscopic gynecologic surgery, these results are still inconsistent with each other now [12, 13].

In our research, after taking different anesthesia methods in patients' surgery, we found that the anesthesia effects of general anesthesia combined with continuous epidural anesthesia group were much better than those of general anesthesia and continuous epidural anesthesia, which was of statistical difference ($P<0.05$). Hemodynamic variables of the patients undergoing general anesthesia combined with continuous epidural anesthesia were significantly better than those of the patients undergoing general anesthesia and continuous epidural anesthesia, which was of statistical significance ($P<0.05$). Assisted mechanical ventilation in the general anesthesia could not only control the movement of diaphragmatic muscles to discharge carbon dioxide, but also ensure patients with good ventilation. Studies have indicated that after using the method of general anesthesia, surgical oxygen saturation and the occurrence of acidosis was relatively less while noradrenaline and adrenaline within the body of the patients would still continue to increase under the stimulation of various elements. Changes in internal environment would affect the respiratory and circulatory function [14, 15]. In addition, studies have indicated that, compared with the epidural combined venous group, the awareness rate in general anesthesia usually increased [16, 17]. However, the awake time of patients undergoing general anesthesia combined with continuous epidural anesthesia was shorter. The intravenous injection of propofol could reduce the stimulation of artificial pneumoperitoneum to peritoneum and indisposition in special posture. What's more, with the reduced amount of continuous epidural anesthesia drugs, it could effectively control the occurrence of neuroendocrine reactions during surgery [18]. Pure continuous epidural anesthesia without endotracheal intubation might lead to respiratory depression because of overdose of anesthesia [19]. Thus, general anesthesia combined with continuous epidural anesthesia had a little impact on blood gas changes of patients and the result was better.

Compared and analyzed the adverse reactions, degrees of satisfaction, laxity of abdominal muscles and the effectiveness of analgesia in each group, the results showed that there were no severe complications in all groups and the overall safety was quite certain. The rate of adverse reactions of patients undergoing general anesthesia combined with continuous epidural anesthesia was remarkably lower than that of general anesthesia and continuous epidural anesthesia, in which the difference was statistically significance ($P<0.05$). The degrees of satisfaction of the general anesthesia combined with continuous epidural anesthesia group were higher and it was widely accepted by health care workers. It was more suitable for clinical promotion, which was consistent with the results of some studies abroad [20]. In addition, patients of analgesia undergoing general anesthesia combined with continuous epidural anesthesia were 100% satisfied with the abdominal muscle relaxation effects and the analgesia effects. Because general anesthesia combined with continuous epidural anesthesia could effectively block the conduction of noxious stimulus to brain centers, reduce the tone of gangliated nerve within region of block and expand blood vessels and stress reactions, at the same time the impacts of artificial pneumoperitoneum on body could be compensated, ensuring the best effect of abdominal muscle relaxation and analgesia.

To draw a conclusion, applying continuous epidural anesthesia combined with general anesthesia in gynecological laparoscopic surgery was effective with a little impact on respiratory and circulatory function, low incidence rate of adverse reactions and relatively high safety. Meanwhile, it was recognized and accepted by patients, which was worthy of a clinical application. However, there were some limitations in this research, for example, the sample capacity was small. In future studies, we still need to confirm the results through clinical trials of multi-center, randomized controls and a larger size of sample.

Disclosure of conflict of interest

None.

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