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*Original Article*

# Effect of enhanced recovery after surgery on curative effect and prognosis of patients undergoing laparoscopic hysterectomy for cervical cancer

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**Abstract:** Objective: To observe the effect of enhanced recovery after surgery (ERAS) on the curative effect and prognosis of patients undergoing laparoscopic radical hysterectomy for cervical cancer. Methods: A prospective randomized controlled study was conducted on 144 patients with cervical cancer treated with laparoscopic radical hysterectomy. The patients were randomly divided into the observation group (72 patients treated by ERAS) and the control group (72 patients treated by conventional nursing) according to the random number table. The length of hospital stay, postoperative exhaust time, out-of-bed activity time, pelvic drainage tube removal time, pelvic drainage volume, postoperative pain degree, postoperative quality of life within 1 month and postoperative complications of the two groups were observed and compared. Results: The length of hospital stay, postoperative exhaust time, out-of-bed activity time and removal time of pelvic drainage tube in the observation group were shorter than those in the control group ($P<0.05$), and the pelvic drainage volume in the observation group was less than that in the control group ($P<0.05$). The pain score of the observation group was lower than that in the control group at 24 h, 3 d and 5 d after operation ($P<0.05$). One month after operation, the role-emotional, bodily pain, social functioning, physical functioning and role-physical in the observation group were higher than those in the control group ($P<0.05$), and the total incidence of complications in the observation group was lower than that in the control group ($P<0.05$). Conclusion: Laparoscopic hysterectomy with ERAS can accelerate the recovery of patients, improve their postoperative quality of life, and reduce the degree of postoperative pain and complications.

**Keywords:** Enhanced recovery after surgery, cervical cancer, laparoscopic surgery, curative effect, prognosis

## Introduction

Cervical cancer is a common gynecological tumor, whose incidence ranks fourth among all female tumor patients in the world, with 560,000 new cases of cervical cancer every year [1]. It is particularly prevalent in low-and middle-income countries. Some studies have found that the incidence of cervical cancer ranks second among gynecological tumors in low-and middle-income countries, and this disease always accompanies with delayed diagnosis [2-4]. Surgical treatment is still the mainstream treatment method for early cervical cancer. With the development of surgical technology, laparoscopic minimally invasive surgery has been extensively applied in clinical practice and has achieved significant effects [5, 6]. Previous research demonstrated that laparoscopic surgery had advantages of less trauma, less bleeding and faster recovery [7, 8]. Although laparoscopic surgery is becoming more and more mature clinically, complications such as postoperative pain and postoperative infection are still inevitable [9]. Therefore, the optimization of patient care during perioperative period is conducive to patients' rehabilitation and acceleration of the recovery as well as the improvement of their quality of life.

Enhanced recovery after surgery (ERAS) is a kind of optimization of perioperative treatment and nursing of patients, which specifically refers to the optimization of peri-operative mea-

sures of patients on the basis of evidence-based medicine, so as to achieve the purpose of reducing psychological and physiological trauma of patients, reducing stress caused by surgery, promoting the recovery of gastrointestinal function and reducing postoperative complications [10, 11]. Moreover, ERAS model runs through the whole process before, during and after operation, which takes disease diagnosis, nursing and rehabilitation as an organic whole to promote the rehabilitation of patients [12-15]. Today, ERAS has been applied in many disciplines abroad and enjoyed superior results [16, 17], while initially, this model is first used in rectal cancer surgery. Although its perioperative application in the field of gynecological surgery is still in the exploratory stage, patients who have applied ERAS to laparoscopic radical hysterectomy for cervical cancer in China report that it is effective to promote wound healing, reduce postoperative complications and postoperative pain [18]. Based on this, a prospective randomized controlled study was thus conducted to observe the effect of ERAS on the efficacy and prognosis of laparoscopic radical hysterectomy for cervical cancer, so as to determine the clinical value of ERAS in patients undergoing laparoscopic surgery for cervical cancer and provide more references for clinical practice.

## Materials and methods

### *Clinical data*

This study was approved by the Medical Ethics Committee of West China Second Hospital of Sichuan University, Key Laboratory of Birth Defects and Related Diseases of Women and Children (Sichuan University). A prospective randomized controlled study was conducted to select 144 patients admitted to the department of gynaecology from October 2016 to October 2018 who underwent laparoscopic radical hysterectomy for cervical cancer. The patients were equally divided into the observation group (n=72) and the control group (n=72) by the random number table method, and intervention was carried out by ERAS and traditional nursing respectively. All the enrolled subjects were aged 30-68 years, with an average age of 42.3±8.3 years. Written informed consent was obtained from each patient included in this study.

### *Inclusion criteria*

(1) Patients underwent total hysterectomy and bilateral accessory resection and lymphatic dissection by laparoscopy after cervical scraping smear, and were confirmed as cervical cancer by two senior pathologists; (2) Patients without mental illness who could cooperate with treatment; (3) Patients without severe cardiopulmonary disease; (4) Patients with TNM stage Ib-IIa; (5) Patients with normal blood coagulation and bone marrow function; (6) Patients with complete clinical data.

### *Exclusion criteria*

(1) Patients combined with cardiac dysfunction; (2) Patients combined with other primary malignant tumors; (3) Patients with abnormal blood coagulation or bone marrow function; (4) Patients with liver and kidney dysfunction; (5) Patients who could not cooperate with the treatment or study; (6) Patients with major bleeding during laparoscopy who turned to thoracotomy; (7) Patients with incomplete clinical data.

### *Methods*

Patients in the control group were treated with traditional methods of rehabilitation perioperative treatment [19], including: (1) Admission education: including medical history inquiry, ward environment introduction, safety knowledge (such as prevent falling off the bed) related education, introduction of competent physician and nurse, introduction of ward visiting hours and visiting system, publicity and education of diet related knowledge, and introduction of surgery. (2) Postoperative out-of-bed training: the nurse in charge encouraged patients to get out of bed after operation. (3) Instead of conventional analgesic drugs, 50-100 mg flurbiprofen (Tide Pharmaceutical, Co., Ltd., Beijing, China) was given intravenously when the patients' VAS score was more than 4 points. (4) The drainage tube was removed if the blood image and body temperature of the patient were normal, the postoperative 24 h pelvic drainage was less than 100 mL/d, and there was no purulent, chylous and bloody drainage. (5) Antibiotic use: prophylactic use of antibiotics was applied 30 minutes before surgery and routine use of antibiotics for 3 days was applied after surgery.

Patients in the observation group were treated with ERAS, which referred to the *Expert Consensus on Perioperative Management of Enhanced Recovery after Surgery in China* in 2016 [20], including:

*Health education*: (1) Admission health education: In the outpatient reception, the outpatient physician distributed perioperative related leaflets to patients, so that the patients had a preliminary understanding of the perioperative period. After admission, the nurse in charge of the bed taught the patients the relevant knowledge and application methods of ERAS, and informed the patients of the inducement of cervical cancer, the mechanism of occurrence and development, the treatment methods of different stages and the prognosis of the disease. To educate the harm of smoking to the human body and the necessity of quitting smoking, so that patients and their families could actively cooperate to accelerate the implementation of rehabilitation surgery in the perioperative period. (2) Frequency of publicity and education: Educational lectures were held twice a week, mainly for preoperative patients and their families, and the head nurse was responsible for explaining. (3) Education contents: Addressing the process of ERAS and its importance, so that patients had a certain understanding of the surgery. In addition, the current department level was introduced to eliminate the patients' doubts and build the patients' confidence in treating the disease. The key points of cooperation from patients before and after the operation were also highlighted, including preoperative preparation, postoperative feeding and postoperative activities, aiming to actively communicate with patients to timely solve the difficulties encountered by patients, so that patients could maintain a relaxed and comfortable state before and after the operation.

*Early respiratory function recovery training and out-of-bed activities*: Patients were encouraged to get out of bed and stood up 6 hours after operation. One day after operation, patients were required to get down to the ground for 30 minutes. If there was no discomfort or the pain was tolerable, patients should get out of bed as soon as possible.

*Analgesic management*: Prophylactic analgesia was performed within 3 days after surgery, that is, 50-100 mg of flurbiprofen was intravenously injected every 12 h.

*Drainage tube removal*: When the patient's body temperature was normal and hemogram was not infected, with a daily drainage volume of less than 300 mL/d and clear drainage fluid, the drainage tube was removed.

*Use of antibiotics:* Patients were routinely treated with 1.5 g cefuroxime (Livzon Pharmaceutical Group Inc., Zhuhai, China) plus 100 mL normal saline at 30 min before the operation. If the operation lasted for more than 3 hours, antibiotics were used again after operation, and continued for one day every other day. If the operation time was less than 3 hours, antibiotics were routinely used for one day after operation.

*Outcome measures*

*Main outcome measures*: (1) Postoperative length of hospital stay of patients: The hospitalization days were counted from the hospitalization to the discharge of the patient after the operation was completed. (2) Postoperative exhaust time of patients: The time from the completion of the operation to the patient's first anal exhaust. (3) Postoperative free movement time of patients: The time of postoperative patients to freely get out of bed in the ward for more than 30 minutes without discomfort was recorded (in hours). (4) Pelvic drainage tube removal time and drainage volume of patients: Postoperative patient's removal time of the pelvic drainage tube and the amount of drainage during removal were recorded. (5) Postoperative pain of patients: Visual analogue scale/score (VAS) method was employed to quantify the subjective pain sensation. A 10 cm scale was used, with the starting and ending points of 0 and 10 respectively, where 0 represents no pain and 10 represents the most severe pain experienced by the patient. Patients were asked to select a point between 0-10 according to their degree of pain, and this very point was the patient's VAS score. The patient's pain degree was measured at 24 hours, 3 days, and 5 days after surgery [21]. (6) Evaluation of patients' quality of life 1 month after operation: Patients' quality of life score was evaluated according to the short form 36-item Health Survey (SF-36) [22]. With a score ranging from 1 to 100 points, the score was positively correlated with quality of life.

**Table 1.** Comparison of general data and baseline data in the two groups

| Group | Observation group (n=72) | Control group (n=72) | $\chi^2$/Z/t/ | P |
|---|---|---|---|---|
| Age (years) | 42.1±8.3 | 42.5±8.3 | 0.261 | 0.795 |
| Cancer type | | | | |
| Adenocarcinoma | 9 | 13 | 0.858 | 0.354 |
| Squamous cell carcinoma | 63 | 59 | | |
| cTMN staging (case) | | | | |
| Ib Stage | 61 | 60 | 0.052 | 0.820 |
| IIa Stage | 11 | 12 | | |
| Differentiation degree (case) | | | | |
| Well differentiated | 42 | 41 | 0.224 | 0.822 |
| Moderate differentiation | 26 | 26 | | |
| Poorly differentiated | 4 | 5 | | |
| Type 2 diabetes (n, %) | 10 (13.89) | 11 (15.28) | 0.056 | 0.813 |
| Hypertension (n, %) | 25 (34.72) | 23 (31.94) | 0.125 | 0.724 |
| Hyperlipidemia (n, %) | 18 (25.00) | 16 (22.22) | 0.154 | 0.695 |
| Obesity (n, %) | 26 (36.11) | 22 (30.56) | 0.500 | 0.480 |
| Smoking (n, %) | 8 (11.11) | 9 (12.50) | 0.067 | 0.796 |

*Secondary outcome measures*: Postoperative complications: The number of postoperative complications, including urinary tract infection, systemic inflammatory response, incision infection, urinary retention, intestinal obstruction, and bleeding, were recorded. Complication rate = number of complications/total number of patients × 100%.

*Statistical analysis*

The continuous variables were expressed as mean ± standard deviation ($\bar{x}$ ± sd) by SPSS 17.0 statistical software, and t-test was adopted for normal distribution and homogeneity of variance. One-way ANOVA was used for comparison at different time points within the group, and the post-hoc test was performed by LSD test. Multi-point comparisons were performed using repeated measures analysis of variance combined with LSD post-hoc tests. Rank sum test was utilized for non-compliance with normal distribution and homogeneity of variance. The grade data were expressed by nonparametric test, while the counting data were expressed by the number of cases/percentage (n/%) and verified by Pearson chi-square test. P<0.05 indicated that the difference was statistically significant.

## Results

*There were no significant statistical differences in general data and baseline data between the two groups*

Though comparable, there were no statistically significant differences in age, cancer type, cTMN staging, and differentiation degree between the two groups of patients (P>0.05) (**Table 1**).

*The evaluation indexes of postoperative nursing effect were better in the observation group than in the control group*

The observation group presented shorter hospital stay, postoperative exhaust time, out-of-bed activity time, and pelvic drainage tube removal time, as well as less pelvic drainage volume than the control group (P< 0.05) (**Table 2**).

*The postoperative pain score in the observation group was lower than that in the control group*

The pain scores of the two groups were evaluated at 24 hours, 3 days and 5 days after operation. The results showed that the pain scores of the observation group were lower than those of the control group no matter at 24 h, 3 d or 5 d after surgery. In addition, the intra-group comparison revealed that the pain scores on the 3rd and 5th day were reduced than that at postoperative 24 h in both groups, with statistically significant difference (P<0.05) (**Table 3**).

*The score of postoperative quality of life in the observation group was higher than that in the control group*

The score of quality of life did not differ significantly between the two groups before intervention, while the scores of physical functioning (PF), role-physical (RP), social functioning (SF), role-emotional (RE) and bodily pain (BP) identified marked differences one month after inter-

**Table 2.** Comparison of related indexes after operation between two groups of patients

| Project | Observation group (n=72) | Control group (n=72) | t | P |
|---|---|---|---|---|
| Hospital stay (d) | 8.94±2.38 | 12.01±3.97 | 5.628 | <0.001 |
| Postoperative exhaust time (h) | 21.14±2.72 | 26.43±3.15 | 10.785 | <0.001 |
| Pelvic drainage volume (mL) | 132.13±3.68 | 299.87±5.17 | 18.265 | <0.001 |
| Out-of-bed activity time (h) | 24.63±2.20 | 29.54±3.07 | 11.023 | <0.001 |
| Pelvic drainage tube removal time (d) | 2.91±0.33 | 5.50±0.63 | 6.039 | <0.001 |

**Table 3.** Comparison of postoperative pain scores

| VAS pain score | Observation group (n=72) | Control group (n=72) | F | P |
|---|---|---|---|---|
| 24 hours after operation | 2.65±0.52[&] | 4.85±0.65 | 344.893 | <0.001 |
| 3 days after operation | 1.04±0.27[&,*] | 2.07±0.27[*] | | |
| 5 days after operation | 0.37±0.36[&,*,#] | 1.25±0.38[*,#] | | |
| F | 1087.347 | 321.895 | | |
| P | <0.001 | <0.001 | | |

Note: [*]compared with 24 h after operation, [#]compared with 3 days after operation, [&]compared with control group, P<0.05.

**Table 4.** Comparison of quality of life scores between two groups of patients at 1 month after surgery

| Project | Observation group | Control group | t | P |
|---|---|---|---|---|
| General health (GH) | 75.10±3.28 | 75.19±3.29 | 0.119 | 0.906 |
| Mental health (MH) | 91.50±3.34 | 90.22±2.85 | 1.084 | 0.750 |
| Physical functioning (PF) | 90.05±2.81 | 74.19±3.17 | 23.203 | <0.001 |
| Role-physical (RP) | 76.73±6.46 | 65.85±6.15 | 7.764 | <0.001 |
| Social functioning (SF) | 85.35±5.46 | 73.35±5.46 | 9.627 | <0.001 |
| Role-emotional (RE) | 79.65±6.22 | 66.81±9.87 | 6.878 | <0.001 |
| Bodily pain (BP) | 37.18±4.03 | 32.14±4.28 | 5.139 | <0.001 |
| Vitality (VT) | 91.50±3.34 | 90.22±2.85 | 1.804 | 0.750 |

vention between the observation group and the control group, among which the indexes of PF, RP, SF, RE and BP of the former were better than those of the latter. Whereas, there were no significant differences in general health (GH), mental health (MH) and vitality (VT) between the two groups (P>0.05) (**Table 4** and **Figure 1**).

*The total incidence of postoperative complications in the observation group was lower than that in the control group*

Postoperative complications between the two groups were found to be statistically insignificant in intestinal obstruction, systemic inflammation, urinary retention, bleeding, urinary tract infection and incision infection (P>0.05), but the overall incidence of complications was significantly lower in the observation group than in the control group (P<0.05) (**Table 5**).

## Discussion

In terms of studies on postoperative recovery, the results of a previous meta-analysis included 7 randomized controlled studies with a total of 486 patients showed that the application of ERAS model could shorten hospitalization time, cut down hospitalization costs and reduce postoperative complications, thus accelerating postoperative recovery [23]. In another case, ERAS combined with laparoscopic surgery was used to treat patients with cervical cancer, and it was found that the postoperative pain score in the group treated by ERAS combined with laparoscopic surgery significantly decreased, with less pelvic drainage time and shortened hospital stay [24]. In this study, the application of ERAS model led to reduced hospital stay, shortened postoperative exhaust time, early out-of-bed activity time and removal time of pelvic drainage tube, and lower hospitalization cost than those of the control group, which was consistent with the above results.

As to postoperative pain, previous studies demonstrated that surgical trauma gave rise to a significant increase in potassium secretion, and meanwhile the increase of pain-causing factors resulted in sensory peripheral nerve pain [25], so it was quite necessary for ERAS to implement pain management in perioperative

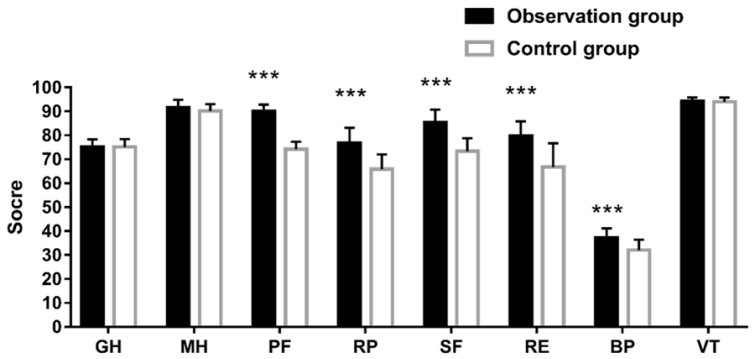


**Figure 1.** Comparison of quality of life between two groups of patients after 1 month of treatment. GH: general health, MH: mental health, PF: physical functioning, RP: role-physical, SF: social functioning, RE: role-emotional, BP: bodily pain, VT: vitality. Compared with control group, ***indicated P<0.001.

**Table 5.** Comparison of postoperative complications

| Postoperative complications | Observation group (n=72) | Control group (n=72) | $\chi^2$ | P |
|---|---|---|---|---|
| Intestinal obstruction | 2 (2.78%) | 4 (5.56%) | 0.174 | 0.677 |
| Systemic inflammation | 1 (1.39%) | 3 (4.17%) | 0.257 | 0.612 |
| Urinary retention | 1 (1.39%) | 3 (4.17%) | 0.257 | 0.612 |
| Bleeding | 4 (5.56%) | 4 (5.56%) | 0.000 | 1.000 |
| Urinary tract infection | 0 (0.00%) | 2 (2.78%) | 0.507 | 0.476 |
| Incision infection | 2 (2.78%) | 4 (5.56%) | 0.174 | 0.677 |
| Total number of cases | 10 (13.89%) | 20 (27.78%) | 4.211 | 0.040 |

period [26]. There was evidence showing that postoperative pain score decreased more significantly in the laparoscopic surgery group using ERAS [27]. While other research exhibited that conventional prophylactic use of nonsteroidal analgesics under the ERAS model could not only relieve pain, but also have no effect of paralyzing gastrointestinal tract compared with opioid receptor analgesics, which was conducive to the recovery of gastrointestinal peristalsis [28, 29]. Another study revealed that the use of ERAS model and prophylactic analgesia helped patients remove the catheter and get out of bed as early as possible on the one hand, and on the other hand, it strengthened the blood circulation of patients, promoted the repair of wound and urethra, and guaranteed the quality of rehabilitation of patients [30]. In the present study, the pain score of the observation group was lower than that of the control group at 24 hours, 3 days and 5 days after operation, which accorded with the previous studies.

Studies on the quality of life indicated that [31], the physical and mental health of cancer patients exerted great impact on the prognosis and quality of life, and the psychological attention and counseling of cancer patients could profoundly improve their mood and quality of life. For cancer disease itself, patients will regard it as a source of stress, and proactive and correct response to this stress can lead to a better prognosis [32, 33]. Previous studies on the quality of life of patients with cervical cancer indicated that bodily pain exerted a significant impact [34], plus the fact that patients were always caught in psychological shadow and adverse psychological emotions in terms of role-emotional [35], both of which in turn put the social and physical functioning of patients in jeopardy. Active psychological counseling under ERAS mode is beneficial to the recovery of physical pain and disease, so this study also found that the observation group was significantly better than the control group in role-emotional, bodily pain, social functioning, physical functioning and role-physical in the quality of life score after the intervention of ERAS mode, which was consistent with the above research.

Concerning postoperative complications, studies revealed that the use of ERAS model can reduce the incidence of postoperative complications [23]. Another meta analysis, which included 13 randomized controlled trials, included a total of 1910 people. It was found that following the guidelines of ERAS effectively reduced the incidence of total postoperative complications and systemic complications [36]. This study also found that the use of ERAS model could reduce the incidence of postoperative complications in international patients with cervical cancer after laparoscopy, which was in line with the above study.

There is still room for improvement in this study. First, the sample size of this study was small, so it is necessary to further expand the sample size in our future research. In addition,

it is necessary to further increase the follow-up time, so as to further systematically evaluate the effect of nursing intervention measures to accelerate rehabilitation on the medium and long-term efficacy of patients undergoing laparoscopic radical hysterectomy for cervical cancer.

In conclusion, patients undergoing laparoscopic radical hysterectomy for cervical cancer with ERAS can speed up recovery, improve the quality of postoperative life, and reduce the degree of postoperative pain and complications.

## Disclosure of conflict of interest

None.

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