ORIGINAL RESEARCH ARTICLE

Short-term efficacy of laparoscopic type C radical hysterectomy by deep uterine vein approach for treatment of cervical cancer

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Abstract

This was an original research. The objective of the study was to investigate the efficacy of laparoscopic type C radical hysterectomy by deep uterine vein approach in treating cervical cancer. Two hundred cases of cervical cancer were allocated into control group and intervention group. The control group underwent pelvic lymph node dissection + para-aortic lymph node resection followed by extensive hysterectomy. The intervention group underwent laparoscopic type C radical hysterectomy by deep uterine vein approach + pelvic lymph node dissection ± para-aortic lymph node resection. In comparison with the control group, the intervention group had significantly lower amount of blood loss, longer time of indwelling catheter, shorter time of abdominal drainage tube removal and anal exhaust, lower incidence of postoperative complications, higher rate of pathological stage upgrading, and higher quality of life score, and had lower recurrence rate. We conclude that laparoscopic C-type radical hysterectomy by deep uterine vein approach is effective, safe and reliable, and can promote patients quality of life, which is valuable for clinical use. *(Afr J Reprod Health 2024; 28 [12]: 73-81).*

Keywords: deep uterine veins; cervical cancer; laparoscopy; type C hysterectomy

Résumé

Il s'agissait d'une recherche originale. L'objectif de l'étude était d'étudier l'efficacité de l'hystérectomie radicale laparoscopique de type C par approche veineuse utérine profonde dans le traitement du cancer du col de l'utérus. Deux cents cas de cancer du col de l'utérus ont été répartis dans le groupe témoin et le groupe d'intervention. Le groupe témoin a subi un curage ganglionnaire pelvien + une résection ganglionnaire para-aortique suivie d'une hystérectomie étendue. Le groupe d'intervention a subi une hystérectomie radicale laparoscopique de type C par approche veineuse utérine profonde + curage ganglionnaire pelvien ± résection ganglionnaire para-aortique. Par rapport au groupe témoin, le groupe d'intervention présentait une perte de sang significativement plus faible, une durée de cathéter à demeure plus longue, une durée plus courte du retrait du tube de drainage abdominal et de l'échappement anal, une incidence plus faible de complications postopératoires, un taux plus élevé d'évolution du stade pathologique et un taux plus élevé. score de qualité de vie et présentait un taux de récidive plus faible. Nous concluons que l'hystérectomie radicale laparoscopique de type C par approche veineuse utérine profonde est efficace, sûre et fiable, et peut améliorer la qualité de vie des patientes, ce qui est précieux pour une utilisation clinique. *(Afr J Reprod Health 2024; 28 [12]: 73-81).*

Mots-clés: connaissances, attitude, pratique, grossesse, facteur de risque

Introduction

Cervical cancer belongs to a type of the most frequent cancer types that endanger women's health all over the world, with a lower incidence and fatality rate as compared to breast cancer, colorectal cancer, and lung cancer[1]. In 2020, there were about 604,000 new cases of cervical cancer all over the world, and approximately 342,000 deaths[2]. Radical hysterectomy (RH) plus pelvic lymph node dissection belongs to the standard surgical procedure for early cervical cancer. Type C hysterectomy refers to the complete dissociation of the deep uterine vein (DUV) and its insertion before its return to the internal iliac vein. This is an important anatomical marker that demonstrate the sufficient removal of the principal ligament in extensive hysterectomy[3]. In 2021, Horie *et al.*[4] reported a new direct laparoscopic radical resection of cervical cancer that found the DUV.

The surgical team of our hospital learned from this method to search for the DUV at the beginning of surgery, and improved the laparoscopic C-type radical hysterectomy, which formed a unique DUV approach.

Therefore, our study aimed to explore the short-term efficacy of laparoscopic type C radical hysterectomy by DUV approach for treatment of cervical cancer. Our study found that laparoscopic type C radical hysterectomy by DUV approach for treatment of cervical cancer is effective, which might provide a promising treatment method for cervical cancer.

Methods

Two hundred patients aged 29-75 years, with an average age of 50.7±10.6 years admitted to The Affiliated Huai'an No.1 People's Hospital of Nanjing Medical University from February 2021 to October 2023 were chosen. There were 114 cases with contact vaginal bleeding, 35 cases with bloody leukorrhea, and 51 cases of cervical cancer detected by routine screening. Histopathology of cervical biopsies revealed 12 cases of adenocarcinoma and 188 cases of squamous cell carcinoma. Based on the 2018 FIGO staging[5], there were 92 cases of B1 stage, 55 cases of B2 stage, 20 cases of B3 stage, and 33 cases of IIA stage. Fifty patients with essential hypertension, diabetes along with coronary heart disease were well controlled before operation and met the operation conditions. Utilizing the random number table method, patients were divided into a control group (CG) and an intervention group (IG). Each group had 100 cases. As shown in Table 1, no significant differences were exhibited in general data between the two groups (P>0.05) .

Inclusion criteria included the following: (1) combined with pathological diagnosis, gynecological examination and MRI diagnosis of cervical cancer IA1 lymph-vascular space invasion (LSVI) ~ IIA stage (gynecological examination was completed by the same chief and deputy chief physician, and imaging reading was reviewed by the same chief physician of imaging department). Extensive laparoscopic hysterectomy plus pelvic lymphadenectomy ± para-aortic lymphadenectomy was performed by the same team and perioperative management was implemented. (2) Preoperative evaluation of tolerance to general anesthesia and surgery. (3) Normal coagulation index, no fertility requirements.

The exclusion criteria were: (1) there were serious diseases of the heart, kidney, liver as well as other organs. (2) received neoadjuvant chemotherapy or radiotherapy before surgery. (3) there were surgical contraindications; (4) History of other major abdominal operations. (5) incomplete clinical data.

Laparoscopic type C radical hysterectomy by DUV approach

The IG underwent laparoscopic type C radical hysterectomy by DUV approach + pelvic lymph node dissection ± para-aortic lymph node resection. Endotracheal intubation was implemented under general anesthesia, bladder lithotomy position was taken, pneumoperitoneum was established by inserting a Veress needle into the umbilical region and filling with CO_2 (pressure 12 mm Hg, 1 mm Hg= 0.133 kPa), the skin of the umbilical region was cut about 1 cm, trocar and lens were inserted, and other puncture points were performed after no obvious abnormalities were found in the abdominal cavity. The selection of puncture site was the same as that of conventional radical cervical cancer surgery. After insertion into the abdomen, the isthmus of the fallopian tubes was closed with bipolar coagulation, the fundus of the uterus was sutured in a figure eight with a 1-0 incision, a set of rings was made above the knot, and an auxiliary hole was made from 2 cm above the pubis, and the ring was inserted with a needle holder for suspension of the uterus.

Extensive total hysterectomy: (1) The DUV was directly located under laparoscopy, the ureter was located in the posterior lobe of the broad ligament, the peritoneum was opened directly above the ureter, and the periureteric fascia tissue was separated. By lifting the ureter and continuing to separate its dorsal fascia in the direction of the bladder to the pelvic floor, the DUV can be gradually revealed (Figure 1A). The lymph node tissue surrounding the DUV was removed and isolated for pathological examination.

Table 1: General data of patients (n=100, x±s)

Groups	**Age (years)**	**BMI**	**Pathological type**		**Clinical stage**				**Complications***	**EORTCQLQ-C30 score (points)**
			Adenocarcinoma	Squamous carcinoma	Stage IB1	Stage IB2	Stage B3	Stage IIA	Yes/No	
Control group	49.3±10.3	23.45±2.45	5	95	51	25	10	14	26 74	48.5±7.5
Intervention group	52.1±10.7	22.95±2.39	7	93	41	30	10	19	24 76	47.2±7.3
t (χ^2) value	*t*=-1.832	*t*=1.461	χ^2=0.355			χ^2=2.299			χ^2=0.107	*t*=1.242
P vale	0.068	0.146	0.552			0.513			0.744	0.216

Note: *CG: 5 cases of diabetes, 19 cases of essential hypertension, 2 cases of coronary heart disease; IG: 7 cases of diabetes mellitus, 15 cases of essential hypertension, 2 cases of coronary heart disease. The EORTCQLQ-C30 score referred to the Quality of Life Scale 30.

The DUV was traced in the direction of the bladder, and the superior vesical veins (possibly 2 or 3), vascular clamp double clamp the deep uterine vein and its branch and the superior vesical vein could be seen (Figure 1B). (2) The free fascia tissue above the ureter gradually revealed the uterine artery, and the internal iliac artery bifurcation was double closed with a vessel clamp. (3) When the attachment was removed, the ovarian dynamic (static) pulse was clipped, and the ovarian dynamic (static) pulse was free at the side of the ureter across the common iliac blood vessel, and the vascular clamp was double clipped. (4) The treatment of pericervical space, principal sacral ligaments and vesico-cervical ligaments was the same as that of standard cervical radical resection. The anterior and posterior walls of the vagina were tied with a ligature at 3.0 cm from the fornix, and the vaginal wall was cut in a circular manner.

The specimens were placed in a specimen bag and removed completely from the vagina. The pelvic cavity was removed from the common iliac artery, from top to bottom, and from outside to inside the common iliac artery, around the iliac and external iliac vessels and in the obturator fossa, and placed into the specimen bag. Dissection of para-aortic lymph nodes: The surface vessel sheathing of the abdominal aorta was opened along the left and right common iliac artery up to the level of the inferior mesenteric artery. Lymph nodes on the surface of the inferior vena cava and lymph nodes on the right side of the abdominal aorta were separated from the top down and from the shallow to the deep. Simultaneously, the upper ureter on the right side of the inferior mesenteric artery, inferior vena cava, and the left side of the abdominal aorta were exposed and avoided. The vaginal stump was sutured. After the abdominal cavity was washed with normal saline and no obvious bleeding was detected, the 43 ℃ distilled water was retained in the abdominal cavity for 20 min, then the drainage tube was placed. Fig1

Laparoscopic routine route surgery

The CG underwent laparoscopic routine route surgery, with pelvic lymph node dissection + para-aortic lymph node resection followed by extensive hysterectomy.

Different from the IG, the DUV was not searched and clipped at the initial stage.

Postoperative treatment

All patients accepted routine prophylactic antibiotics for 48 h after surgery, drainage tubes were removed following the specific conditions of patients, and patients were encouraged to get out of bed as soon as possible. After discharge, the patient was asked to review the stump liquid based cytology, HPV, gynecologic vaginal B-ultrasound, squamous cell antigen and pelvic MRI at regular outpatient clinic.

Observed indicators

Operation time (from disinfection of the operative area to completion of the skin incision suture), intraoperative blood loss (from the beginning of the operation to the completion of the epidermal incision suture), number of lymph node dissection, indwelling catheter time (the criteria for the success of catheter removal: urinary residual urine after catheter removal was negative), anal exhaust time, antibiotic use time, and abdominal drainage tube removal time (the criteria for removal: If the total amount of peritoneal drainage was lower than 200 ml for 2 consecutive days and 24 h, the postoperative hospital stay (discharge criteria: the patient returned to normal diet for 3 days, could move out of bed autonomously, there was no sign of infection in the surgical incision, and no complications or complications requiring hospitalization).

Complications: Postoperative observation of patients for incision infection, deep vein thrombosis, as well as urinary system leakage.

Quality of life: Patients' quality of life before as well as 3 months after surgery was assessed by referring to EORTCQLQ-C30 scale[6], which was a self-rating scale in the form of questionnaire, involving three dimensions: functional domain (emotion, role, social function and cognition), symptom domain (nausea, vomiting, fatigue and pain) and general health, with a total score of 100, quality of life and score The number was positively related to the level.

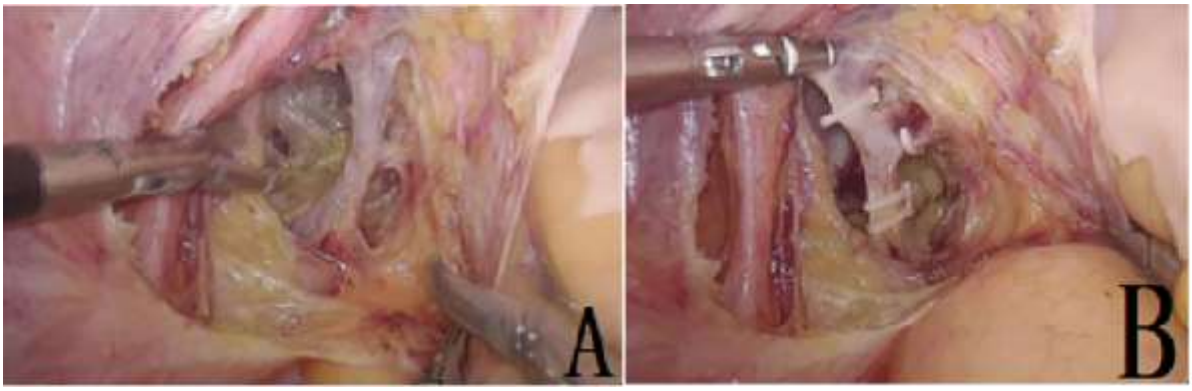

Figure 1: Description of Laparoscopic type C radical hysterectomy by DUV approach. A. The peritoneum directly above the ureter was opened, the fascia tissue around the ureter was separated towards the bladder to expose the DUV. The parafunctional lymph node tissue surrounding the DUV was resected. B. Vascular clamp double clamp DUV and its branches and superior vesical vein (blue arrow for ureter, orange arrow for DUV, green arrow for superior vesical vein).

Postoperative pathological escalation and postoperative tumor recurrence.

Statistical analysis

All data were processed by SPSS 27.0 software. The measurement data of normal distribution were expressed by (x±s) and independent sample t test was used. Statistical data were measured by χ^2 test. P<0.05 meant statistical significance.

Ethical considerations

All patients signed the informed consent, and our study was approved by the Ethics Committee of The Affiliated Huai'an No.1 People's Hospital of Nanjing Medical University in January 2021

Results

Operation situation

When compared to the Vescio CG, the IG presented had less blood loss (P<0.001), shorter extraction drainage time along with anal exhaust time (P<0.05), and longer catheterization time (P<0.05). In contrast, there was no statistical significance between the two groups in the operation time, number of lymph nodes dissection, antibiotic use time, and hospital stay (P>0.05). The score of EORTCQLQ-C30 after surgery was higher in both groups than before surgery, but that in the IG presented higher than the CG (P<0.05, Table 2). The incidence of postoperative complications in the IG was 3.0% (3/100), significantly lower than that of 11.0% (11/100) in the CG (P<0.05), as unveiled in Table 3.

Postoperative pathology

The rate of pathological stage upgrading in the IG was 14.0% (14/100), higher than that of 5.0% (5/100) in the CG (χ^2=4.711, P=0.030). Among the upgraded cases in the IG, 4 cases were caused by positive peri-uterine lymph nodes, as revealed in Table 4.

Follow-up

The follow-up period ended in October 2023. The IG was followed up for 4 to 29 months, (18.9±6.5) months, and the CG was followed up for 3 to 28 months, (18.7±6.1) months. There was no recurrence in the IG, and the 5 cases in the CG were postoperative pathological upgraders, with a recurrence rate of 5.0% (5/100). The recurrence time was 12 to 18 months after postoperative chemoradiotherapy combined with anti-angiogenic drugs. Among them, three cases were stable after chemotherapy combined with anti-angiogenic drugs, and one case had ureteral and urological hydrops, and the symptoms were relieved after J-tube placement in the urinary system. At present, it is still in survival with tumor, and one case of recurrent gastrointestinal bleeding during treatment died of ineffective rescue.

Table 2: Comparison of intraoperative and postoperative conditions between 2 groups (x±s, n=100)

Groups	Amount of bleeding (ml)	Operation time (min)	Number of lymph nodes dissection (coins)	Catheter retention time (d)	Drainage tube removal time (d)	Anal exhaust time (h)	Duration of antibiotic use (d)	Length of hospital stay (d)	EORTC QLQ-C30 scale score
Control group	115 (100, 187.5)	298.6±52.2	21.5±6.9	19.1±5.5	13.9±5.5	45.3±5.1	9.3±3.1	13.8±4.2	64.6±9.3
Intervention group	100 (20, 100)	301.4±55.5	22.4±7.9	20.8±5.2	12.1±5.2	38.5±4.3	8.6±4.2	13.2±2.6	78.1±10.5
T (*Z*) value	*Z*=-5.056	*t*=-0.367	*t*=-0.890	*t*=-2.176	*t*=2.351	*t*=10.194	*t*=1.341	*t*=1.196	*t*=-9.625
P value	<0.001	0.714	0.375	0.031	0.020	0.000	1.181	2.233	0.000

Table 3: Comparison of postoperative complications between 2 groups (n=100)

Groups	Urinary system leakage	Deep venous thrombosis	Vascular injury	Total
Control group	6 (6.0)	3 (3.0)	2 (2.0)	11 (11.0)
Intervention group	2 (2.0)	1 (1.0)	0 (0.0)	3 (3.0)
χ^2 value	4.916			
P value	0.027			

Table 4: Comparison of postoperative pathological stage upgrading between the two groups (n=100)

Groups	Positive pelvic lymph nodes (%)	Negative pelvic lymph nodes (%)	Positive para-aortic drenching (%)
Control group	5 (5.0)	0 (0.0)	0 (0.0)
Intervention group	6 (6.0)	4 (4.0)	4 (4.0)

Discussion

Controversy over different surgical procedures

Compared with transabdominal cervical cancer surgery, laparoscopic type C radical hysterectomy by DUV approach not only combines the advantages of laparoscopy with obvious spatial sense, magnification and clear operating field, but also seeks DUV at the beginning of surgery, and frees and ligates DUV throughout the operation to lessen the risk of cancer cell metastasis during the operation[7]. Laparoscopic cervical cancer surgery is controversial. In 2018, the New England Journal of Medicine published a Laparoscopic Approach to Cervical Cancer (LACC) clinical trial led by the American Gynecologic Oncology Group[8], proposing that in comparison with open surgery, minimally invasive surgery has a higher recurrence rate while reducing the disease-free survival rate. A retrospective article from Northwestern University[9] published in the same period reported that the 4-year mortality rate of minimally invasive surgery was higher than the open surgery.

Nevertheless, some scholars have queried the results of LACC[10,11], believing that the short follow-up time, the missing data, and the experience and proficiency of the surgeon will also have an impact on the results. They recommend that large-scale prospective studies are still required to further confirm the influence of laparoscopic surgery on prognosis. The Chinese Expert Consensus on Laparoscopic Surgery for Cervical Cancer, updated in 2020, pointed out[12] that the application value of laparoscopy in cervical cancer should not be completely negated by the current controversy, and it is necessary to strictly grasp the indications of minimally invasive surgery for cervical cancer, containing small cervical lesions, well-differentiated cervical lesions, and no deep muscle invasion. Simultaneously, attention should be focused on the principle of no tumor during the operation, and it is recommended to replace the original uterine organ lifting method to avoid squeezing the tumor tissue.

Vaginal closure below the tumor tissue should be performed before vaginal dissection. The resected lymph node tissue was placed in a specimen bag and removed. Irrigate abdominal cavity with water for injection. Patients as well as their families should be fully informed of relevant risks before surgery, and their choices should be respected.

Analysis of advantages and disadvantages of operation

In comparison with the CG, the IG presented less amount of blood loss, which was considered to be linked to the fact that in the IG, the DUV was found and its branch was clamped as the first step of the operation, so that the anatomical structure and surgical field of view were clearer, and the bleeding caused by unclear anatomical level during the operation was reduced. The prognosis of cervical cancer surgery is closely linked to the tumour stage at the time of treatment and the scope of initial surgery. In addition to the scope of paratropectomy, the degree of lymph node dissection is also crucial. No difference could be discovered in the number of lymph node dissection between 2 groups. By comparing with the CG, the IG presented higher retention time of urinary tube, which was roughly the same as the removal time of urinary tube after deep vein approach reported by Luciana Silveira Campos *et al.*[13], which may be linked to the following two factors: (1) Most cases did not retain the pelvic autonomic nerve, but underwent C2-type hysterectomy, which affected the blood supply of the bladder along with the function of the pelvic autonomic nerve; (2) In the early stage of the new operation, there were failed cases of urinary tube removal. In the subsequent stage, the IG did not try to remove the urinary tube in a short period, and the removal was reserved to 3 to 4 weeks as far as possible. With the accumulation of clinical

experience, we tried to preserve the pelvic autonomic nerve during the operation for suitable cases and removed the urinary tube as soon as possible after surgery. Relative to the CG, the IG presented shorter time of anal exhaust and abdominal drainage tube removal, indicating the superiority of the new operation.

Urinary tract fistula belongs to a common complication of cervical cancer surgery. Laparoscopic deep venous approach can reduce the occurrence of intraoperative bladder and ureteral injury caused by the initial clamping of the DUV and its branches, resulting in less intraoperative bleeding, clearer vision and finer anatomy. In the IG, 4 patients were upgraded from early cervical cancer to stage IIIC due to positive paruterine lymph nodes, and further follow-up chemoradiotherapy was required for these cases. The lack of knowledge of parafunctional lymph nodes in the past will lead to misdiagnosis of some advanced cervical cancer patients with positive parafunctional lymph nodes and delay the treatment opportunity. The fine separation of the DUV and its subordinate branches and the resection of the parametrial lymph node tissue around the DUV is in line with the concept of parametrial lymph node (PLN) resection alone, which improves the detection of PLN and avoids missed metastasis[14], and the IG avoided the missed diagnosis of metastasis, so that patients could get timely and effective comprehensive treatment and promote the prognosis.

Quality of life and survival rate of cancer patients

Recently, the age of onset of cervical cancer is gradually getting younger[15,16]. Surgical treatment is the main treatment in clinical practice, and extensive hysterectomy is the most classic, but this operation has a large resection range and is prone to damage of blood vessels and nerves, ultimately affecting t patients' quality of life[17]. The two main goals of clinical treatment of cancer are to promote the quality of life and increase the survival rate. In this research, by comparing with the CG, the score of EORTCQLQC30 presented higher in the IG after surgery.

The anatomical level of the IG was clear, which was conducive to the clear identification of pelvic nerves and blood vessels, convenient for the operator to completely separate the blood vessels, promote patients' quality of life, along with promote postoperative recovery. Lee et al.[18] believed that the damage of pelvic autonomic nerve caused by radical cervical cancer surgery caused problems of bladder (such as urinary incontinence, dysuria, etc.), rectum (flatulence, constipation, fecal incontinence, etc.) and sexual dysfunction after surgery. The Querleu-Morrow classification updated in 2017 once again emphasized that C1-type surgery is the mainstream surgery[19]. Nevertheless, due to the complex structure of pelvic autonomic nervous system, C1-type surgery still lacks the standardization of surgical techniques and procedures so far, and only a few studies have pointed out its efficacy[20]. In this research, the DUV approach clearly exposed the full course of the DUV at the initial stage of surgery, so it is also suitable for C1-type hysterectomy. After exposing the DUV, the pelvic autonomic nerve injury caused by unclear identification of the pelvic visceral nerve and pelvic nerve plexus can be reduced. In this study, there were no recurrence cases in patients undergoing the new operation during postoperative follow-up. Nevertheless, due to the short follow-up time, it is still necessary to wait for further clinical observation to understand the long-term survival rate.

Strengths and limitations

This is a large-sample, randomized, and noninferiority trial study. Our study found that laparoscopic type C radical hysterectomy by DUV approach for treatment of cervical cancer is effective, which might provide a promising treatment method for cervical cancer. Short-term follow-up is the main limitation of our study

Conclusion

Laparoscopic type C radical hysterectomy by DUV approach has accurate short-term efficacy, safety and reliability, and patients recover quickly after surgery, which can promote the quality of life along with improve the survival rate.

Conflicts of interest

All authors declare no conflicts of interest in this study.

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Contribution of authors

Juanpeng Yu and Ting Wang: conceived and designed the study as well as collected and analysed the data. Shengsheng Yu and Yingchun Gao: prepared the manuscript. All authors mentioned in the article approved the manuscript.

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