Application of Novel Tumor-free Techniques in Laparoscopic Radical Hysterectomy for Early Cervical Cancer.

Huining Jing

West China Second University Hospital of Sichuan University

Junying Zhou

West China Second University Hospital of Sichuan University

Xuting Ran

West China Second University Hospital of Sichuan University

Wenjiao Min

Sichuan Academy of Medical Sciences & Sichuan Provincial People's Hospital

Zhengyu Li (✉ zhengyuli01@126.com)

West China Second University Hospital of Sichuan University

Research Article

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Abstract

Objective: Minimally invasive radical hysterectomy has been historically considered oncologically equivalent to open radical hysterectomy for patients with early cervical cancer. However, it was recently reported to be significantly inferior in long-term outcomes of the minimally invasive approach to open approach. The underlying causes of this finding arouse great concern and remain controversial. Here we would like to share some initial experience of tumor-free techniques in laparoscopic procedures for early cervical cancer, including uterine manipulator-free manipulation and enclosed colpotomy.

Methods: Between December 2019 and May 2020, we performed manipulator-free laparoscopic radical hysterectomy in 26 cases with early cervical cancer. The modified tumor-free techniques, including uterine manipulator-free manipulation and enclosed colpotomy, was described in detail with illustrations.

Results: The procedures went well in all patients. In our initial experience, these modifications do not increase the difficulty of surgical techniques, and can be well performed by the experienced surgeons.

Conclusions: These techniques are safe and feasible, and the effects on oncological outcomes deserve follow-up and further clinical studies.

Introduction

Globally, cervical cancer continues to be the fourth most common cancer among females, and 85% of new cases and 90% of deaths occur among people from socioeconomically weaker sections of society[1]. China reported 98, 900 new cases of cervical cancer and 30, 500 deaths in 2015[2]. Previous editions of guidelines[3] indicate that either open or minimally invasive surgery is an acceptable surgical treatment to radical hysterectomy (RH) in patients with early-stage (IA2 to IIA) cervical cancer. These recommendations have led to a widespread use of laparoscopic approach in recent years after the implementation of laparoscopy during the 1990s. A meta-analysis based on 26 previous retrospective researches shows better intraoperative and short-term postoperative outcomes of laparoscopic approach compared with open approach in cervical cancer[4]. Moreover, laparoscopic surgery has not been related with lower long-term survival outcomes in numerous studies. However, Ramirez *et al* [5]reported a multicenter randomized controlled trial (RCT), namely the Laparoscopic Approach to Cervical Cancer, LACC trial, showed that laparoscopic approach was associated with lower 4.5-year disease-free survival (DFS), progression-free survival (PFS), overall survival (OS) and disease-specific survival rates and a higher local recurrence rate than the laparotomic approach, which aroused great controversy worldwide.

LACC is a study of tremendous significant but it does not dig the underlying reasons further. Some gynecologic surgeons believed that some laparoscopy-specific factors, including the use of a uterine manipulator, intracorporeal unenclosed colpotomy, prolonged steep Trendelenburg position and high-pressure CO2 pneumoperitoneum, conspire to place patients at risk for recurrence[6]. But till now there was no data or literature to support these hypotheses. Interestingly, it seems to be the case only with cervical cancer. Previous randomized controlled trials comparing laparoscopy with open surgery in

clinical early-stage endometrial cancer[7] and non-metastatic colon cancer[8, 9] had reported equivalent survival rates and reduced surgical morbidity.

In general, the laparoscopic approach of cervical cancer in some degrees violates the basic principles of oncologic surgery such as incompressibility the tumor and avoidance of tumor spillage.

Since the LACC trial was made public, we have been thinking about the possible causes of poor prognosis of laparoscopic approach. Therefore, according to our experience, we have made some improvements in the laparoscopic procedures of cervical cancer, mainly to pay attention to the tumor-free principles to avoid the iatrogenic tumor dissemination.

Procedures

This work was approved by the Institutional Ethics Committee of Sichuan University, and an informed consent was obtained from individual participants for taking and publishing the photographs. Between December 2019 and May 2020, we performed manipulator-free laparoscopic radical hysterectomy in 26 cases with early cervical cancer. The modified tumor-free techniques, including uterine manipulator-free manipulation and enclosed colpotomy, were described in details as follows. Patients underwent laparoscopic radical hysterectomy with pelvic lymphadenectomy under general anesthesia. The patient was placed in the Trendelenburg position.

1. Manipulator-free manipulations of the uterus

A total of 4 ports were used (10-mm camera port 2cm above the umbilicus, 5-mm port at McBurney's point on the right side for the assistant, and two 5-mm ports on the left side for the surgeon, one was symmetric with the McBurney's point another was the midpoint of lower left port and camera port.) (Fig. 1A). A suture needle with a 1-0 non-absorbable suture was passed through the skin into the abdominal cavity from right upper quadrant. The suture was made in the fundus of uterus and the other side of the suture got out of the abdominal cavity through the left upper quadrant. lifting the uterus by the outer parts of the suture. (Fig. 1B, 1C)

A total of 5 ports were used. Four ports were consistent with above mentioned, the extra was a 5-mm port 2cm above the symphysis pubis, which was used for insertion of the laparoscopic grasping forceps when traction of the uterus was applied (Fig. 2A). A 1-0 non-absorbable suture was placed through the fundus of uterus, tied this suture tightly to form the first knot and tied the second knot 2cm apart to create a ring in the middle, and a laparoscopic grasping forceps is inserted from the port above the symphysis pubis to pull the suture to manipulate the uterus. (Fig. 2B, 2C)

2. Enclosed colpotomy

2.1 Cable tie ligating

Before the resection of the upper third of the vagina, a sterilized cable tie was used to ligate the upper vagina (Fig. 3A).

2.2 Endoscopic stapler cutting

We also used the endoscopic stapler to close the vagina, the Fig. 3B showed the method of vaginal closure with an endoscopic linear cutting stapler with single use loading units.

2.3 transvaginal resection

Twenty three of 26 patients had transvaginal resection. Transvaginal resection was an alternative method that avoided tumor exposure in the abdominal cavity. We clamped the cervix with two forceps and dragged it out through the vagina (Fig. 3C, 3D).

3. pelvic cavity douche

To clear the potential residual tumor cells in the abdominal cavity thoroughly, we flushed the pelvic cavity with 2000 ml normal saline (NS) after the intraperitoneal procedures.

4. Bagging the resected lymph nodes

The resection of pelvic lymph nodes and para-aortic lymph nodes (if necessary) is an important part of cervical cancer surgery. Resected lymph nodes were immediately bagged when we do the laparoscopic lymphadenectomy and the specimen bag was removed from the vaginal stump after the operation.

To date we completed a total of 26 cases of this manipulator-free laparoscopic radical hysterectomy in early-stage cervical cancer. The procedures went well in all patients, with the difficulty similar to the conventional laparoscopic radical hysterectomy. The average estimated blood loss was 100 ± 80 ml, and the operative time was 220 ± 60 min in manipulator-free laparoscopic radical hysterectomy, similar to those in conventional group. There was no intra-operative transfusion, injury or conversion to open surgery in manipulator-free laparoscopic radical hysterectomy. In the short-term follow up, there was no post-operative transfusion, ileus, urinary tract injury or infection, vaginal cuff dehiscence, incisional infection or incisional hernia development. There were 4 cases of post-operative fever and 3 cases of deep venous thrombosis (DVT), who all got well after conventional management. Considering that the incidence of DVT after gynecologic surgery in our hospital is about 10%, we don't think it's an abnormal data.

Discussion

The laparoscopic approach for early cervical cancer has been widely used for more than 20 years since it was first reported in 1989[10]. Previous studies of our group indicated that the adverse effect of laparoscopic approach for cervical cancer patients was influenced by tumor size[11, 12]. A multicenter retrospective study just published by our group found the same results with LACC trial in patients with a tumor diameter ≥ 2 cm, however, amid the patients with a tumor diameter < 2 cm, the laparoscopic radical hysterectomy and abdominal radical hysterectomy groups had similar disease-free survival (HR 0.71, 95% CI 0.24 to 2.16; $p=0.59$) and overall survival (HR 0.59, 95% CI 0.11 to 3.13; $p=0.53$)[12]. That suggested the laparoscopic procedures such as placing a manipulator through the tumor site may result in tumor fragmentation in women with large neoplasm, which might cause the thrombus of cancer cells to enter micro lymphatics and capillaries to form iatrogenic local or distant metastases.

Similar studies are currently exploring surgical techniques to improve the oncological safety of minimally invasive surgery approaches. Implementation of the tumor-free principles in the laparoscopic procedure was the major concern. Gynecological surgeons tend to believe that the uterine manipulator plays a vital role in increasing the risk. Previously published studies of manipulator-free laparoscopic approach have come up with some solutions. Kanao and colleague[13] reported an application of a “no-look no-touch” procedure including 4 specific measures to prevent tumor spillage: 1) avoidance of a uterine manipulator, 2) creation of a vaginal cuff, 3) minimal handling of the uterine cervix, and 4) bagging of the specimen. Another case report performed abdominal manipulation of the uterus by suturing the round ligament, the ovary ligament, and the fallopian tube together[14]. Our colleagues from West China Second University Hospital recently published a video article to introduce the laparoscopic single-site (LESS) approach with enclosed colpotomy and without uterine manipulator[15]. Similarly, Intracorporeal open colpotomy, the last step of minimally invasive radical hysterectomy, may increase the risk for tumor spillage in the abdominal cavity. A multicenter research of laparoscopic radical hysterectomy with transvaginal closure of vaginal cuff showed similar survival outcomes with open approach[16].

We made every effort to achieve the tumor-free minimally invasive surgery procedures of cervical cancer. In this article, some improvements of the laparoscopic radical hysterectomy based on the tumor-free principles were described, including manipulator-free manipulations of the uterus, enclosed colpotomy, pelvic cavity douche and bagging the resected lymph nodes. We demonstrated two feasible methods of lifting the uterus without insertion a uterine manipulator and three treatments of closing the vagina before transected. These adaptations were meant to minimize tumor extrusion, disruption and diffusion, and reduce the risk of recurrence. We proved that these measures are feasible in practice and reduce the spillage of tumor cells in theory, and follow the principles of tumor-free surgery. These improvements preserved all the advantages of minimal invasive surgery for cervical cancer without increasing any potential risk of adverse effects. The major weakness is that we didn't prove these surgical details are associated with better oncological outcomes, which still requires further verifications of randomized controlled trials.

Minimally invasive surgery technology is in the ascendant in recent years. However, the latest updated FIGO guideline[17] recommends that open surgery should be deemed the 'gold standard' operation for those with Stage IA1 cervical cancers with lymph-vascular space invasion (LVSI) and Stage IB1 cancers. Faced with such a dilemma, we need to be more cautious about whether we should totally abandon a surgical approach in certain cancer. We believe that surgical proficiency should be considered the most important issue of any surgical trial[18]. Improvement of surgical proficiency and implementation of tumor-free principles in the laparoscopic surgical procedure is what we urge gynecologic oncologists to focus.

Declarations

Authors' contributions

All authors made contributions to the study concept and design. J.Z. and W.M. helped to draft the manuscript; H.J. wrote the manuscript; Z.L. proofread and revised the manuscript. H.J. and X.R. prepared figures 1-3 and Z.L. was the responsible surgeon. All authors reviewed and approved the final manuscript.

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Availability of data and materials

The datasets used during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

Ethics approval and informed consent

This study was approved by the Institutional Ethics Committee of West China Second University Hospital. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Additionally, written informed consent was obtained from individual participants for taking and publishing photographs.

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Conflict of interest

The authors declare that they have no conflicts of interest and nothing to disclose.

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Figures

Figure 1

Manipulator-free manipulations of the uterus. (1A) Locations of the 4 ports in method 1 (one camera port 2cm above the umbilicus, one port on the right side for the assistant, and two ports on the left side for the surgeon). (1B,1C) The uterus is lifted through the extraperitoneal part of the suture in the uterine fundus at different angles.

Figure 2

Manipulator-free manipulations of the uterus. (2A) Locations of the 5 ports in method 2 (Four ports were consistent with above mentioned, the extra was a port 2cm above the symphysis pubis, which was used for insertion of the laparoscopic grasping forceps). (2B, 2C) A suture was placed through the fundus of uterus, tied this suture tightly to form the first knot and tied the second knot 2cm apart to create a ring in the middle, and a laparoscopic grasping forceps is inserted from the port above the symphysis pubis to pull the suture to manipulate the uterus.

Figure 3

Enclosed colpotomy. (A) A sterilized cable tie was used to ligate the upper vagina before the resection of the upper third of the vagina. (B) Vaginal closure with an endoscopic linear cutting stapler with single use loading units. (C, D) Transvaginal resection was made to avoid tumor exposure in the abdominal cavity, then we clamped the cervix with two forceps and dragged it out through the vagina.