



Total Laparoscopic Nerve-Sparing Radical Hysterectomy Using the No-look No-touch Technique

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Abstract

Radical hysterectomy is a standard operation for patients with early-stage cervical cancer. Over the recent decades, laparoscopic radical hysterectomy has been considered an alternative treatment. In 2018, the results of the laparoscopic approach to cervical cancer trial suggested that women with early-stage cervical cancer who underwent minimally invasive surgery for radical hysterectomy had poorer prognosis than those who underwent open surgery. This finding was unexpected, and direct evidence supporting poor prognosis related to minimally invasive radical hysterectomy was not available because the trial was not designed to evaluate the cause of the inferior outcomes. Tumor spillage caused by surgeon-related factors, including squeezing of the uterine cervix and tumor exposure to circulating CO₂ gas, is considered to be associated with the poor prognosis of patients who underwent minimally invasive radical hysterectomy. We believe that protective maneuver to avoid tumor spillage is the key to improve oncologic outcomes of cervical cancer. Here, we present a procedure of total laparoscopic nerve-sparing radical hysterectomy for early-stage cervical cancer in which techniques, such as the “no-look no-touch technique,” were used to prevent tumor spillage.

Keywords

- ▶ cervical cancer
- ▶ laparoscopic radical hysterectomy
- ▶ nerve-sparing
- ▶ no-look no-touch technique
- ▶ tumor spillage

Preoperative Evaluation

Patients with early-stage cancer (clinical stage IA2, IB1, IB2, and IIA1 based on the revised 2018 International Federation of Gynecology and Obstetrics staging system) are eligible for laparoscopic radical hysterectomy.¹ It is important to confirm the appropriate indication for laparoscopic surgery.

In this study, pelvic examination, magnetic resonance imaging, and computed tomography were performed for all patients, and the results were assessed in a preoperative meeting, where all gynecologists assembled to discuss the diagnosis and operative procedure.

Patients suspected to have parametrium invasion and/or lymph node metastases should be excluded. Laparoscopic

surgery is not indicated for uterus with a large fibroid that is difficult to extract via the vaginal.

Surgical Steps

There are 12 surgical steps as follows:

1. Creation of a vaginal cuff
↓
2. Placement of the trocar
↓
3. Insertion of the forceps via the vagina
↓

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4. Development of the pararectal and paravesical spaces
- ↓
5. Suspension of the rectum
- ↓
6. Pelvic lymphadenectomy
- ↓
7. Mobilization of the bladder and transection of the upper ligaments
- ↓
8. Dissection around the ureter and transection of the uterine artery
- ↓
9. Transection of the cardinal ligament
- ↓
10. Transection of the posterior layer of the vesicouterine ligament
- ↓
11. Transection of the paracolpium and rectovaginal ligament
- ↓
12. Transection of the paravaginal tissue, extraction of the specimen via the vagina, and closure of the vagina

Explanation of the Surgical Procedure

Tumor spillage is a common concern in laparoscopic surgery for malignant tumor. Several cases have been reported in various fields, including tumor spillage in patients with rectal cancer.^{2,3} Transanal total mesorectal excision, a surgical procedure for rectal cancer, has been associated with higher rate of local recurrence due to the exposure of the tumor caused by anastomotic leakage.³ To the best of our knowledge, tumor perforation, tumor exposure to circulating CO₂ gas, and direct manipulation of the tumor are considered to cause cancer dissemination.³⁻⁶ These issues are considered surgeon-related factors and are preventable.⁷ Therefore, we believe it is important to prevent tumor spillage during laparoscopic operation performed for a patient with cervical cancer.

The following four major aspects of our total laparoscopic radical hysterectomy approach prevent tumor spillage: (1)

creation of a vaginal cuff, (2) manipulation of the uterus without a uterine manipulator, (3) minimal handling of the uterine cervix, and (4) extraction of the specimen in a collection bag. We call this the “no-look no-touch technique.” We reported that total laparoscopic radical hysterectomy using the no-look no-touch technique might be a useful to reduce the risk of recurrence.⁸ Here, we describe these surgical procedures in detail.

Creation of a Vaginal Cuff

Prior to laparoscopic surgery, we create a vaginal cuff for both the prevention of tumor spillage and to create an accurate vaginal incision.

First, approximately 12 to 15 cm sutures are placed around the circumference of the vagina, approximately 1.5 cm away from the tumor (► Fig. 1A). The sutures are pulled to obtain a good view of the incision line. Adrenaline, at a dilution of 1:1,000,000, is administered in the incision line to reduce bleeding. The vaginal mucosa is incised circumferentially, approximately 2 cm away from the tumor (► Fig. 1B), and the connective tissue is scrape down beneath the mucosa using unipolar electrocautery. Subsequently, a vaginal cuff is created by closing the incision with continuous sutures (► Fig. 1C).

Placement of the Trocar

The patient is positioned in the lithotomy position with a Trendelenburg tilt of 10 degrees.

A 12-mm trocar is placed at the umbilicus as a camera port, and three trocars are placed in the lower abdomen (► Fig. 2). The middle port is placed midway between the umbilicus and pubis to perform the laparoscopic procedure easily in the upper area around the common iliac artery; in this position, the middle port is placed relatively higher than its placement in the typical diamond position. A 12-mm trocar, instead of a 5-mm trocar, is used as the right lateral port. We can easily pass gauze in and out through the right 12-mm trocar, especially in case of sudden bleeding.

The primary operator stands on the right side of the patient and uses the middle and left trocars. The first-assistant stands on the right side with a camera and uses forceps inserted through the right trocar to maintain appropriate traction. The second-assistant sits between the patient's legs and manipulates the uterus, as described below.



Fig. 1 Creation of a vaginal cuff. (A) A total of 12 to 15 sutures are placed around the circumference of the vaginal, approximately 1.5 cm away from the tumor. (B) The vaginal mucosa is incised circumferentially, approximately 2 cm away from the tumor. (C) Vaginal cuff closure is completed.

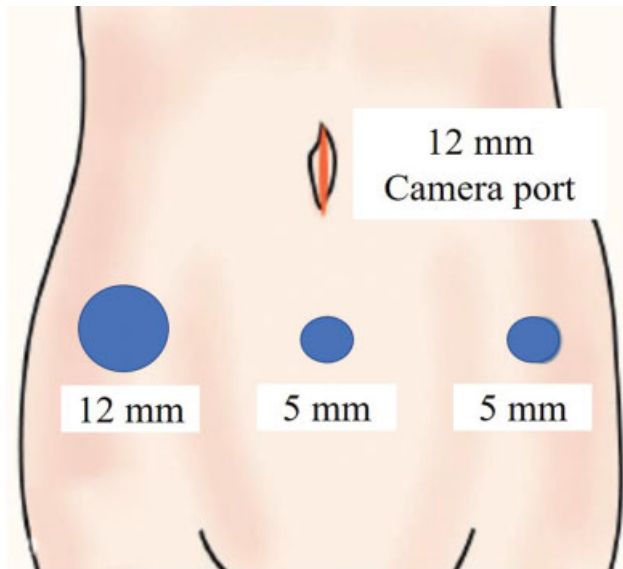


Fig. 2 Placement of the trocars. A 12-mm trocar is placed at the umbilicus as a camera port, and three trocars are placed in the lower abdomen.



Fig. 3 Insertion of forceps via the vagina. (A) A 5-mm extra-long trocar is placed in the posterior vaginal fornix. (B) Forceps are inserted through this trocar, and the thread around the uterine body is gripped by the forceps.

Insertion of the Forceps via the Vagina

A 1–0 absorbable synthetic braided suture is placed around the uterine body. A 5-mm extra-long (150 mm) trocar (Covidien, Mansfield, MA) is placed in the posterior vaginal fornix (► Fig. 3A). We insert the forceps through this trocar, and the thread around the uterine body is gripped by the forceps (► Fig. 3B). By pulling or pushing the uterine thread, the second assistant manipulates the uterus.

Tips and Warnings

In this procedure, a vaginal cuff is created prior to the laparoscopic surgery, thus overcoming the issue of using a uterine manipulator, which results in direct excessive tumor manipulation. When placing an extra-long trocar, the second assistant should be careful to not break the vaginal cuff. The finger should be placed on the side of the trocar to insert an extra-long trocar safely.

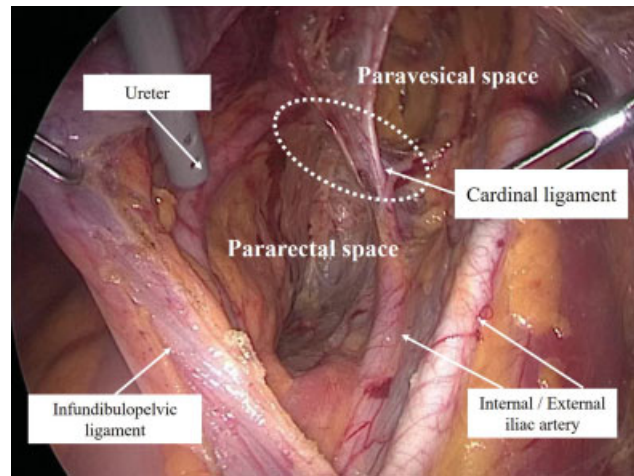


Fig. 4 Development of the pararectal and paravesical spaces (on the right side). We create a wide and deep space. The cardinal ligament is exposed.

Development of the Pararectal and Paravesical Spaces

First, we develop Latzko pararectal space. We begin to open the area circumscribed by the round ligament, the infundibulopelvic ligament, and the iliac vessels. We create a wide and deep pararectal space, with preservation of the mesoureter.

Next, we develop the paravesical space. We begin to develop this space from outside the umbilical ligament. We create a wide and deep paravesical space, with preservation of the vesico-hypogastric fascia. After this procedure, the cardinal ligament is exposed (► Fig. 4).

Subsequently, we scrape the ureter down beneath the posterior leaf of the broad ligament. This results in the development of the Okabayashi pararectal space. After developing the Okabayashi pararectal space, the hypogastric nerve can be identified.

We incised either the infundibulopelvic ligament or ovarian ligament depending on whether we preserve the ovary.

Tips and Warnings

This step is an important procedure as a sufficient and safe operative view, and an appropriate incision line for radical hysterectomy is obtained with this procedure. The pararectal and paravesical spaces consist of avascular connective tissue in principle. Therefore, in step 4, we should fully develop these spaces to expose the important pelvic structures, including the vesico-hypogastric fascia, hypogastric nerve, and cardinal ligament.

Suspension of the Rectum

The rectum is mobilized and lifted upwards by using cotton tape. When we perform the operation from the right side, the rectum is lifted toward the left side. The suture is placed on

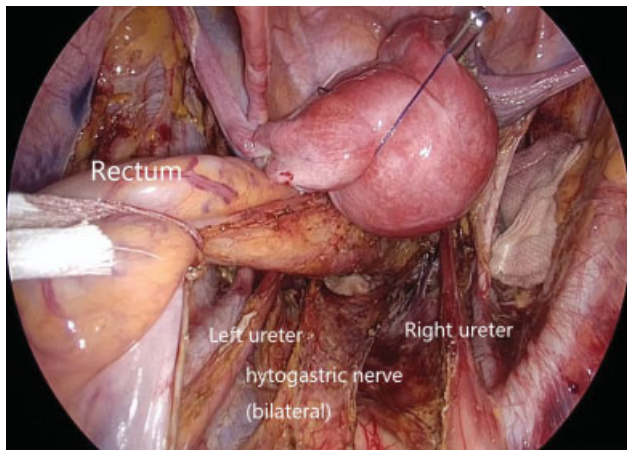


Fig. 5 Suspension of the rectum. The rectum is lifted upwards toward the left using a cotton tape. Behind the rectum, the hypogastric nerve can be seen.

the tape and the thread is fixed in the upper part of the abdominal wall (► Fig. 5).

Tips and Warnings

“Suspension of the rectum” is an unfamiliar concept to a gynecologist; however, it is a very important technique in pelvic surgery. With this technique, the parametrium is exposed and the pararectal and paravesical spaces are developed; thus, sufficient radical hysterectomy can be safely performed, without direct handling of the uterine cervix. Moreover, this technique is effective, even in cases of bulky tumors and obese patients.

Pelvic Lymphadenectomy

We perform en bloc pelvic lymphadenectomy. First, we develop the space between the psoas muscle and the external iliac vessels widely to expose the obturator nerve and vessels. We dissect the fatty tissue, including the lymph nodes, from the boundary of the endopelvic fascia covering the psoas, internal obturator, and levator ani muscles.

We seal the upper end of the lymphatic tracts (around the bifurcation of the common iliac arteries) using an advanced bipolar device to prevent lymphocele formation. Following the sealing of the upper end of the lymphatic tracts, the

lymphofatty tissue is easily scraped down beneath the external and internal iliac vessels.

Next, we separate the lymphofatty tissue from the obturator nerve and vessels. In case of possible lymph node metastases, both the obturator vessels and the lymph nodes are removed to prevent spillage of the remaining cancer cells. We also seal the lower end of the lymphatic tracts using an advanced bipolar device.

Finally, we harvest the internal iliac lymph nodes, and dissect the lymphofatty tissue between the internal iliac vessels and hypogastric nerve, toward the cardinal ligament.

After removing the lymphofatty tissue completely, we place the lymph nodes in a plastic bag to prevent tumor spillage (► Fig. 6A–D).

Tips and Warnings

We must perform pelvic lymphadenectomy with en bloc removal of the lymphatic tissue to prevent scattering cancer cells, lymphatic loss, and blood loss.

For nerve-sparing radical hysterectomy, complete removal of the lymph nodes in the internal iliac region is essential. We perform lymphadenectomy meticulously to expose the cardinal ligament and pelvic nerve networks, including the hypogastric nerve, pelvic splanchnic nerves, pelvic nerve plexus, and their vesical branches.

Mobilization of the Bladder and Transection of the Upper Ligaments

We incise the bladder peritoneum and mobilize the bladder down to the level where the vaginal cuff is placed. We should be careful not to incise the vaginal wall itself, which is weakened by the creation of the vaginal cuff. Finally, we incise the round ligament laterally using an advanced bipolar device.

Dissection around the Ureter and Transection of the Uterine Artery

We dissect the connective tissue around the ureter. The ureter is wrapped by the mesoureter, which is connected to the uterine artery, deep uterine vein, and hypogastric nerve. It is essential to incise each connection to develop a ureteral tunnel.

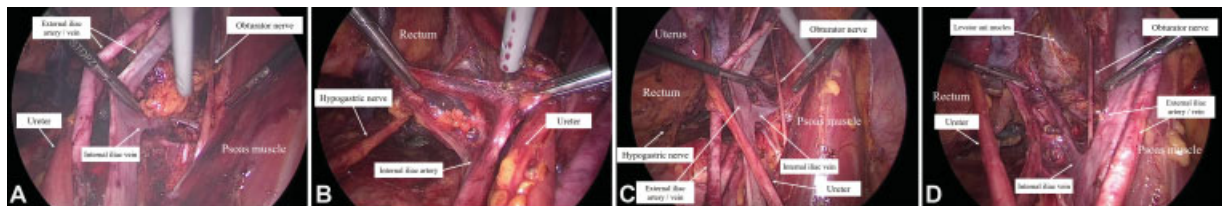


Fig. 6 Pelvic lymphadenectomy (on the right side). (A) Development of the space between the psoas muscle and the external iliac vessels until the obturator nerve are exposed. (B) Harvesting the internal iliac lymph nodes. (C, D) Final view of the pelvic lymphadenectomy.

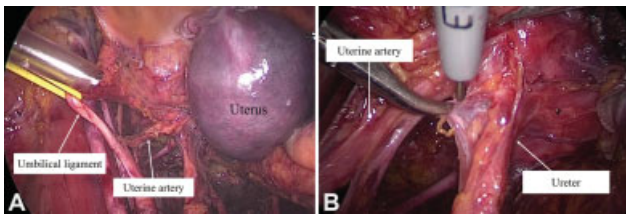


Fig. 7 Dissection around the ureter (on the left side). (A) Hanging the vessel tape around the umbilical ligament to facilitate dissection around the ureter. (B) Incision of the connection around the ureter.

First, we open the fascia circumscribed by the uterine artery, umbilical ligament, and superior vesical artery, thereby isolating the umbilical ligament. We hang the vessel tape around the umbilical ligament to clear the operative field and to facilitate dissection around the ureter (►Fig. 7A). Next, we incise the connection around the ureter. Some branches from the uterine artery can be seen in the connection between the mesoureter and uterine artery, and they are incised by using an advanced bipolar device (►Fig. 7B). After the dissection, a branch from the uterine artery to the bladder is separated (middle vesical artery). We transect the uterine artery and middle vesical artery, and then the uterine artery can be completely isolated from the ureter.

Subsequently, the bladder pillar is dissected meticulously, leading to the isolation of the small vessels between the uterus and bladder (cervico-vesical vessels). We transect the cervico-vesical vessels, and unroofing of the ureter is accomplished.

Tips and Warnings

The ureter is a metanephrogenic organ; therefore, it can be easily dissected from the uterus, which is a mesonephros organ. Embryologically, these positions are reversed, leading to the formation of the fusion fascia around the ureter. Separating this fusion fascia is essential for dissecting the ureter from the uterine-related structures. This concept enables us to perform this procedure safely. Incising the connection around the ureter is similar to mobilizing the fusion fascia around the ureter, such as the Toldt fascia around the colon.

Transection of the Cardinal Ligament

After pelvic lymphadenectomy, the vessels and nerves around the cardinal ligament are already isolated. We clamp and incise only the deep uterine vein, not the vesical vessels. Subsequently, we scrape the incised deep uterine vein upward to the level of the hypogastric nerve, which lies in the upper end of the pelvic nerve network. Thereafter, the pelvic nerve network can be seen (►Fig. 8).

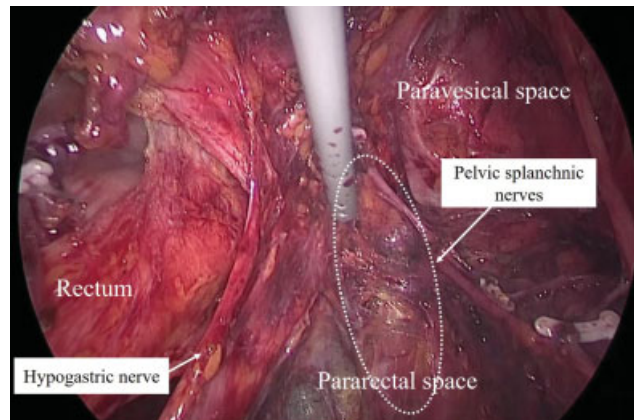


Fig. 8 Pelvic nerve network (on the right side). This network consists of the hypogastric nerve and pelvic splanchnic nerves.

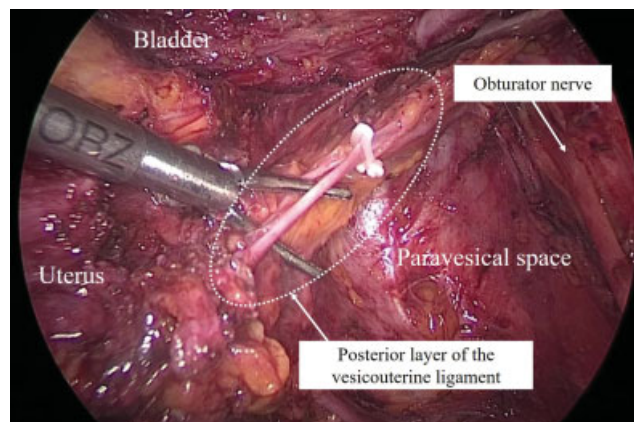


Fig. 9 Transection of the posterior layer of the vesicouterine ligament (on the right side). The posterior layer of the vesicouterine ligament consists of the vesical vessels, nerves, and adipose tissue.

Transection of the Posterior Layer of the Vesicouterine Ligament

The posterior layer of the vesicouterine ligament consists of the vesical vessels, nerves, and adipose tissue; therefore, dissection should be performed meticulously to isolate the vesical veins, which are connected to the deep uterine vein (►Fig. 9). We transect the vesical vein, with preservation of the nerves.

Transection of the Paracolpium and Rectovaginal Ligament

First, we incise the uterine branch from the hypogastric nerve. The paracolpium tissue is sutured above the hypogastric nerve; hence, nerve-sparing radical hysterectomy can be performed (►Fig. 10). The suture is also placed in the uterine body to reduce back bleeding from the uterine body. The paracolpium tissue between the two sutures is incised using scissors.

Next, we incise the Douglas peritoneum and dissect the rectum at the level of the vaginal cuff. Both sides of the rectum are sufficiently dissected, providing a good view of

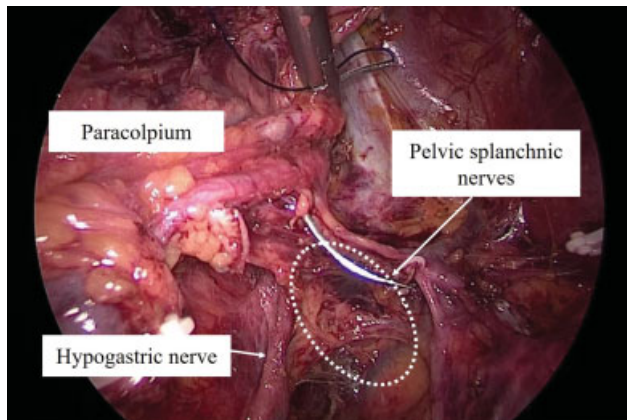


Fig. 10 Transection of the paracolpium (on the right side). The paracolpium tissue is sutured above the hypogastric nerve.

the sacrouterine ligament and rectovaginal ligament. We incise these ligaments using unipolar electrocautery.

Tips and Warnings

Höckel et al demonstrated the concept of total mesorectal resection (TMMR) based on the theory of embryologically defined compartments, in which the Müllerian compartments, except for the distal part, are completely removed.⁹ This concept is theoretical and effective with respect to the radicality and safety of radical hysterectomy.

In TMMR, the resection of the sacrouterine ligament is critical for the radicality of surgery for cervical cancer. Höckel et al demonstrated that incomplete resection of the Müllerian compartments, such as the sacrouterine ligament, leads to poor prognosis of patients who undergo cervical cancer surgery. Although the TMMR theory is controversial, it is important to explore an appropriate surgical margin for radicality and safety.

Transection of the Paravaginal Tissue, Extraction of the Specimen via the Vagina, and Closure of the Vagina

The forceps are removed via the vagina, and a vaginal pipe (VagiPipe; Hakko Co. Ltd, Nagano, Japan) is inserted into the vagina to confirm the incision line. As the vaginal cuff has been created, the vaginal wall can be easily transected.

A plastic bag is used to extract the specimen to prevent the scattering of cancer cells (►Fig. 11A and B). The vaginal mucosa is closed by using single sutures. The abdominal cavity is flushed with a large amount of saline. A pelvic drainage tube is placed in the Douglas space, and the abdominal incision is closed. ►Fig. 12 shows the final operative view after laparoscopic nerve-sparing radical hysterectomy using the no-look no-touch technique.

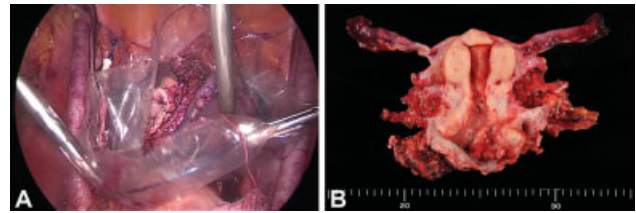


Fig. 11 Extraction and bagging of the specimen. (A) The specimen in the bag is extracted via the vagina. (B) The specimen.

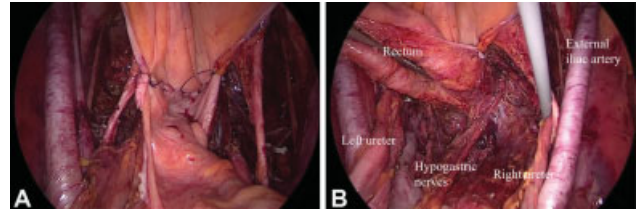


Fig. 12 (A, B) Final operative view during the laparoscopic nerve-sparing radical hysterectomy using the no-look no-touch technique.

Tips and Warnings

A collection bag is used to extract the specimen via the vagina. The technique which involves both the creation of a vaginal cuff and use of a collection bag, directly prevents cancer exposure and abdominal contamination.

Funding
None.

Conflict of Interest
None declared.

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