

Laparoscopic Radical Hysterectomy and Pelvic Lymphadenectomy in the Treatment of Cancer of the Cervix

Histerectomia Radical e Linfadenectomia Pélvica Laparoscópica no Tratamento do Câncer de Colo do Útero

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ABSTRACT

Radical hysterectomy remains the treatment of choice for most patients with early stage cancer of the cervix. Several studies have shown the equivalence – in terms of local control and survival – of laparoscopic surgery compared to the open technique. The benefits of laparoscopy compared to the open surgery are based on the general benefits of laparoscopy, such as less blood loss, less postoperative pain, reduced length of stay and lower hospital costs, and earlier return to work. In this article we describe in detail the techniques of radical hysterectomy and pelvic lymphadenectomy used in the treatment of cancer of the cervix and discuss the results.

Key words: Radical hysterectomy. Pelvic lymphadenectomy. Cancer of the cervix. Laparoscopy.

Braz. J. Video-Sur, 2013, v. 6, n. 2: 060-069

Accepted after revision: february, 13, 2013.

INTRODUCTION

Radical hysterectomy remains the treatment of choice for most patients with early stage cervical cancer. The expected benefits of laparoscopic radical hysterectomy (LRH) instead of open surgery are based on the general benefits of laparoscopic surgery such as less blood loss, less postoperative pain, reduced length of stay and lower hospital costs, and an earlier return to work.^{1,2}

The first radical hysterectomy with laparoscopic pelvic and paraortic lymphadenectomy was performed in 1989 by Nezhat et al and published in 1992.³ Since then the number and quality of scientific reports published has increased gradually, progressing from case series and case-control studies,⁴ to cohort studies,⁵⁻⁷ and finally randomized trials.⁸ The results of these studies – in terms of local and systemic control of cervical carcinoma – are at least equivalent to open surgery.

Although there are some technical variations in radical hysterectomy, these surgeries are now well

standardized. Our objectives are to describe the techniques in detail and discuss their results.

TYPES OF RADICAL HISTERECTOMY

Although there are variations in the surgical techniques used in hysterectomies, radical hysterectomy and modified radical hysterectomy are the most utilized in the treatment of patients with cervical cancer. In recent years, the nerve-sparing radical hysterectomy has been used with increasing frequency because it appears to reduce substantially complications related to urinary retention.

Radical hysterectomy (RH) consists of the resection of the uterus and the parametria along the pelvic wall, with ligation of the uterine artery at its origin. The surgery, called Piver III according to the Piver Classification,⁹ has changed over time.

The modified radical hysterectomy (MRH) – also known as Piver II – consists of the removal of the uterus and parametria at a position just medial to its intersection with the ureters (see below). The

nerve-sparing radical hysterectomy (NSRH) consists of resection of the uterus and the entire parametria, but with preservation of the pelvic splanchnic nerve, hypogastric nerve, and the bladder branch of the inferior hypogastric plexus.

SURGICAL TECHNIQUE

Positioning

The patient, under general anesthesia, is placed in dorsal decubitus. The legs are positioned at 30 degrees of flexion relative to the thigh. There should be sufficient space between the legs to allow complete manipulation of the uterus (Figure 1). The buttocks should extend off the operating table. Improper positioning is one of the most common errors and makes the surgery very difficult.

Both arms should be positioned along the body, so that the surgeon and first assistant may assume ergonomic positions during the surgery. Figure 2 illustrates the positions of the staff and equipment in relation to the patient.

PREPARATION OF THE PATIENT

Preoperative preparation of the patient includes antithrombotic prophylaxis and antibiotic prophylaxis. Randomized studies have demonstrated the benefits of antibiotic prophylaxis in hysterectomies for benign disease.¹⁰ The antibiotic should be administered at least 30 minutes and no more than two hours before the first incision, and continued for no more than 24 hours.

Because dissection of the parametria often results in urinary retention in the immediate postoperative period, once the patient is positioned on the operating table, a Foley catheter is placed in the bladder. Bladder catheterization also helps prevent injuries to the bladder.

Catheterizing the ureters – although not routine in most services – can be done at the beginning of the surgery in cases where the dissection of the ureters is expected to be difficult.

Finally, the surgeon proceeds with the placement of the uterine manipulator. There are various types of manipulators on the market. The uterine manipulator employed should allow ample manipulation of the uterus and vagina, without hindering complete access to the pararectal and paravesicular spaces, rectum, or parametria. The

uterine manipulators equipped to expose the vaginal vault can facilitate the dissection of the vagina.

PLACEMENT OF THE TROCARS

After establishing the pneumoperitoneum according to the surgeon's preferences, four trocars are placed. A 10 mm umbilical trocar, through which a 30° or 0° optic will be used, is introduced first. After placement of this trocar the patient is placed in Trendelenburg and the other three trocars are introduced under direct vision. Two lateral 5 mm trocars are inserted about 2 to 3 cm medial and superior to the anterior superior iliac crest. The final 5 mm trocar is placed in the midline about 8 cm below the umbilical trocar (Figure 3). For short patients or those with a bulky uterus, the optic can be placed in an epigastric position in order to have additional space to the placement of the other trocars and to minimize contact between the instruments.

Once the trocars are positioned, it is important to conduct a thorough inspection of the abdominal cavity, with special attention to the presence of peritoneal implants and lymphadenopathy.

PELVIC LYMPHADENECTOMY (ILIAC AND OBTURATOR CHAINS)

The first step of the radical hysterectomy with pelvic lymphadenectomy is the dissection of the paravesical and pararectal spaces (Figure 4). The round ligament is exposed by uterine manipulation and traction, and then sectioned, after cauterization, along the pelvic wall. Once the round ligament is sectioned, the peritoneum is opened – laterally to the gonadal vessels – for about 5 cm. Some surgeons prefer to keep the round ligament intact during this part of the procedure.

This is followed by the dissection of paravesical space by blunt dissection between the medial aspect of the iliac vessels and lateral aspect of the obliterated umbilical artery. As an avascular virtual space, if bleeding occurs it is likely that the dissection is being conducted in the wrong plane.

The dissection of the paravesical space is extended until the internal obturator muscle is visualized. The same process of traction and counter-traction is used in the dissection of the pararectal space (Figure 4D), taking care so that the ureter is drawn along with the peritoneum medially; this is the medial



Figure 1 - Positioning of the patient, with arms along the body, protected from contact with metal parts of the operating table. Thighs abducted to allow manipulation of the uterus.

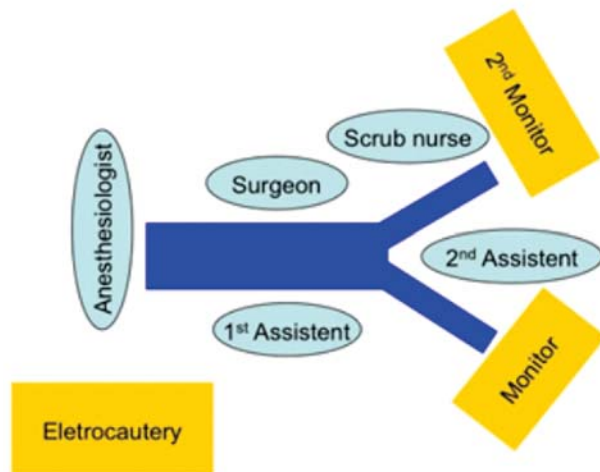


Figure 2 - Layout of the staff and equipment used to perform a LRH with pelvic lymphadenectomy. If is an auxiliary monitor is used, it is positioned next to the patient's left foot.



Figure 3 - Positioning of the trocars in radical hysterectomies.

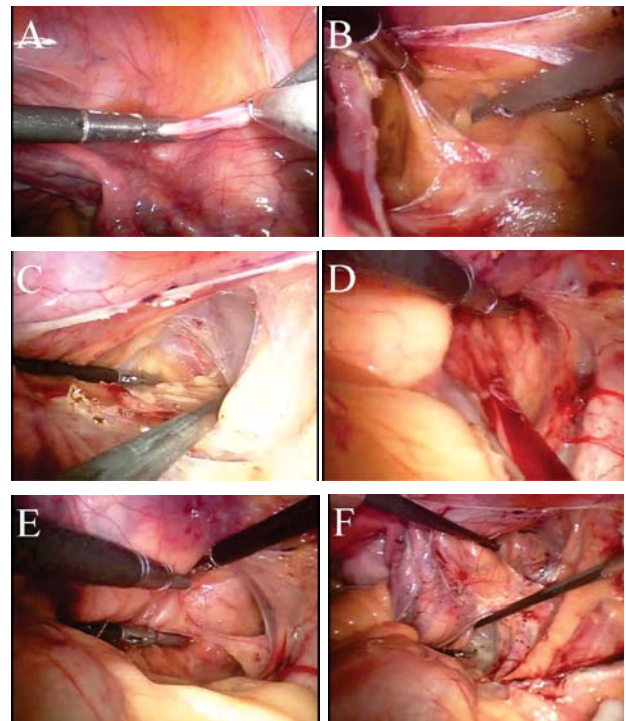


Figure 4 - (A) Sectioning of the round ligament close to the pelvic wall. (B) Traction of the superior vesical artery. (C) Paravesical space dissected, allowing visualization of the internal obturator muscle. (D) Beginning of the dissection of the pararectal space with the internal iliac vessels defining the lateral border. (E) Dissection of the pararectal space by traction and counter-traction while keeping the ureter displaced medially. (F) Paravesical and pararectal spaces dissected.

border of the dissection of this space and the internal iliac vessels constitute the lateral border.

After the creation of these spaces, the pelvic lymphadenectomy is started. Uterine manipulation is used to laterally displace the uterus to the side opposite the lymphadenectomy. Dissection begins with the external iliac artery, continuing laterally to the anterior aspect of the genito-crural nerve (lateral border) (Figure 5A) and distally to Cloquet's node, located internally to the hypogastric vein and superiorly to the internal iliac circumflex vein. Dissection continues over Cooper's ligament by displacing the medial wall of the iliac vein laterally. Retracting the vessels medially and laterally, the obturator fossa and the obturator nerve are exposed. The dissection of the external iliac vessels is then carried out. On the medial side of the external iliac vein one should be careful not to injure the *corona mortis* vein (Figure 5I).

Once the lymphadenectomy of the external iliac vessels is completed, progressing across the inner portion of the pelvic wall, along Cooper's ligament,

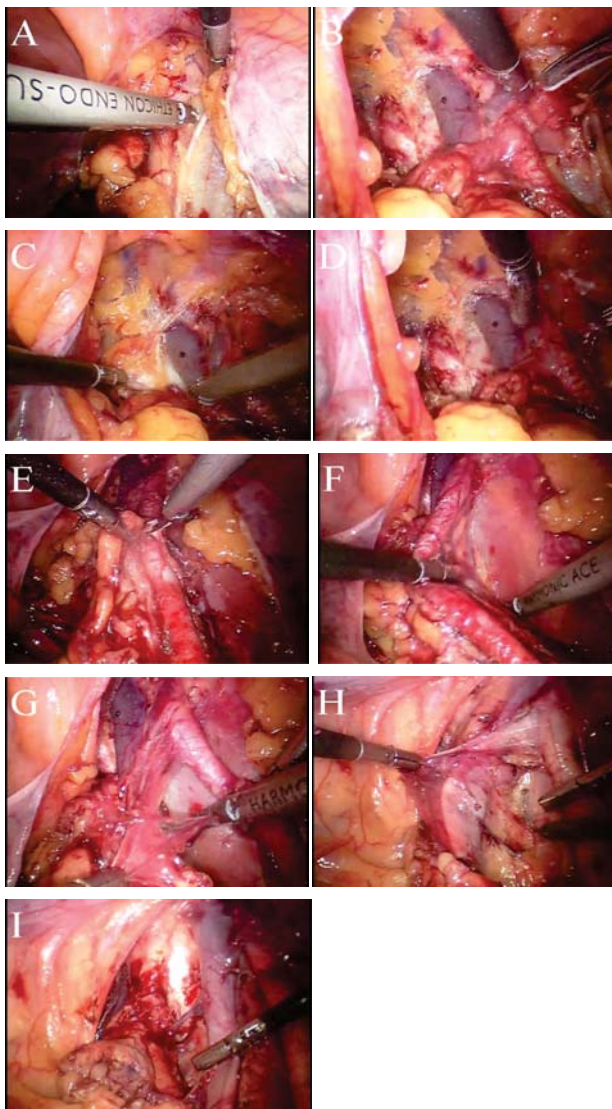


Figure 5 - (A) Dissection lateral to the external iliac artery with preservation of the genito-crural nerve. **(B)** Right deep iliac circumflex vein marking the distal limit of the lymphadenectomy. **(C and D)** Cooper's ligament being dissected by medial traction on the lymphatic chain and lateral traction of the right external iliac vein. **(E)** Dissection of the external iliac artery. **(F)** Dissection of the lateral aspect of the lymphadenectomy by medial traction on the external iliac vessels and exposure of the greater psoas muscle. **(G)** Dissection of the internal face of the external iliac artery. **(H)** Dissection of the lateral face of the vein. **(I)** External iliac vein dissected revealing the corona mortis vein.

the obturator nerve is identified and lymphatic chain is sectioned. Using traction it is possible to separate the lymphatic tissue of the obturator nerve with minimal bleeding, taking care not to damage the obturator vessels. (Figure 6)

The bifurcation of the iliac artery is identified, lymph nodes in this region are dissected and continuing

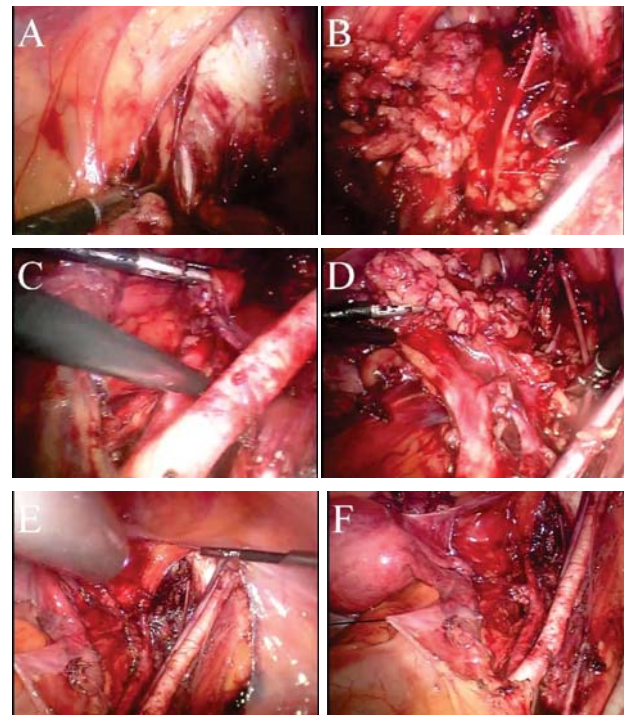


Figure 6 - (A) Identification of the obturator nerve and sectioning of the lymphatic chain. **(B)** Right obturator nerve dissected. **(C)** Lymphadenectomy of the bifurcation of the right iliac artery. **(D)** Lymphadenectomy of the internal iliac vessels. **(E)** Complete internal iliac lymphadenectomy with identification of the origin of the right uterine vessels and the umbilical artery. **(F)** Complete pelvic lymphadenectomy after isolated dissection of the small group of lymph nodes under the ureter and along the common iliac vessels.

distally, the lymph nodes of the internal iliac vessels are dissected until the origin of the uterine vessels is identified (Figure 6D). The lymphadenectomy is then completed by dissection of the lymph nodes of the common iliac vessels, by medial traction of the peritoneum with the ureter and dissection of the region. Occasionally, a stitch in the peritoneum that invests the ureter in this region may assist in the exposure of the vessels (Figure 6F)

The surgical specimens of the lymphadenectomy should be placed inside the fingers of gloves or endobags for later removal with the uterus.

RADICAL HISTERECTOMY

Laparoscopic Radical Hysterectomy (LRH) begins with the sealing and sectioning of vessels of the infundibulopelvic ligament (Figure 7), aided by lateralization of the uterus by uterine manipulation. Sealing can be accomplished by common bipolar cautery, or

sealing instruments such as an ultrasonic scalpel. The sectioning of the posterior peritoneum of the broad ligament extends until close to the ureter (Figure 7C).

The uterus is pushed cranially in the midline in order to separate the bladder from the vaginal wall to the point at which the ureters enter the bladder (Figure 7D and 7E). At this point the uterine artery and vein are sectioned at their origins (Figure 7F) as are the parametria along the pelvic wall. Usually, the uterine vessels can be cauterized with bipolar cautery and sectioned, but the use of clips is an option.

The ureter is then completely dissected along its parametrial course to the point where it penetrates the bladder wall. The ureter can be manipulated with atraumatic forceps, tape, or a penrose drain (Figure 8B). Next the paracolpo, a portion of the lateral external parametrial tissue, inferior and laterally external to the ureter and posterior to the bladder wall

are dissected, allowing complete release of the parametrium and the lateral wall of the vagina.

The dissection of both the ureter and the paracolpo are facilitated by the use of a harmonic scalpel or a similar form of energy that avoids thermal damage to the ureter, and at the same time can ensure adequate hemostasis.

The same steps are performed contralaterally, and then the uterosacral ligaments are sectioned along their complete length and the rectum is freed from the posterior vaginal wall by applying posterior traction to the rectum and anterior traction to the peritoneum lining the pouch of Douglas (Figures 8D to 8F).

We then proceed to the sectioning of the vagina, beginning preferably from the posterior wall, because of possible loss of the pneumoperitoneum, which could interfere with the sectioning (Figure 9A and 9B). Once the vagina is sectioned the uterus is extracted (Figure 9C) followed by the lymph nodes.

After removal of the surgical specimens from the cavity, vaginal suturing can be performed laparoscopically (Figure 10) or vaginally.

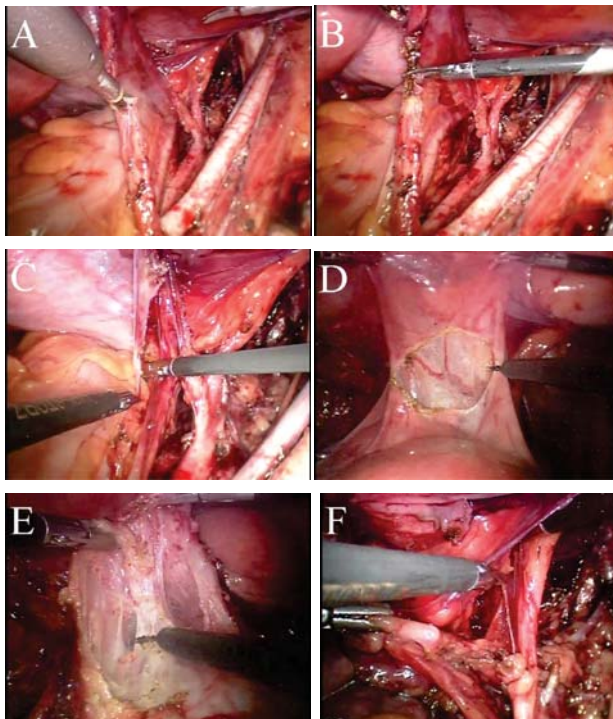


Figure 7 - (A) Bipolar cauterization of the right infundibulopelvic ligament. (B) Sectioning of the infundibulopelvic ligament, with visualization of the right ureter attached to the peritoneum, the internal iliac artery, and the origin of the right uterine artery, as well as the superior vesicular artery and external iliac vessels. (C) Sectioning of the posterior peritoneum of the broad ligament while protecting the ureter. (D) Traction and sectioning of the vesicouterine peritoneum close to the uterus. (E) Dissection of the vesicouterine space. (F) The uterine artery clipped and sectioned at its confluence with the hypogastric artery. In the same figure the sealed and sectioned uterine vein is visible.

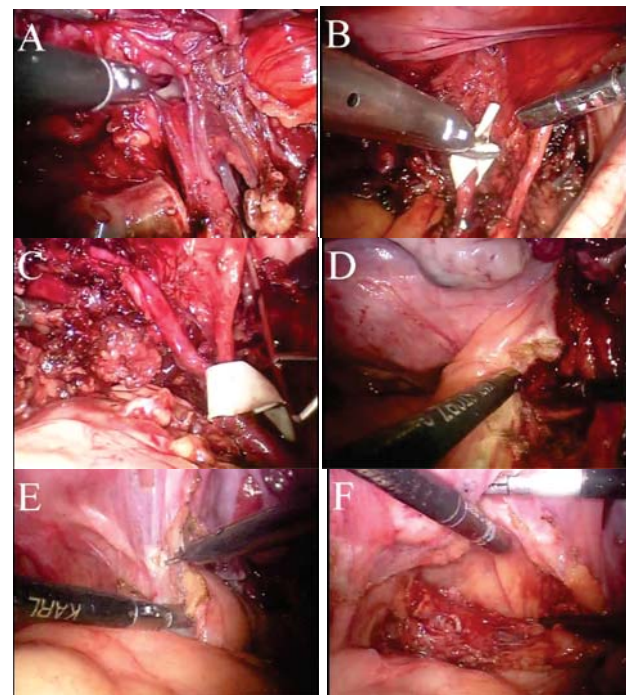


Figure 8 - (A) Freeing of the right ureteral tunnel. (B) Placement of Penrose drain fixed with a clip for manipulation of the ureter. (C) Right ureter freed up to the bladder and the parametrium resected along the pelvic wall. (D) Sectioning of the uterosacral ligament. (E) Sectioning of the peritoneum lining the pouch of Douglas and freed of the rectum. (F) Posterior dissection completed with the rectum released.

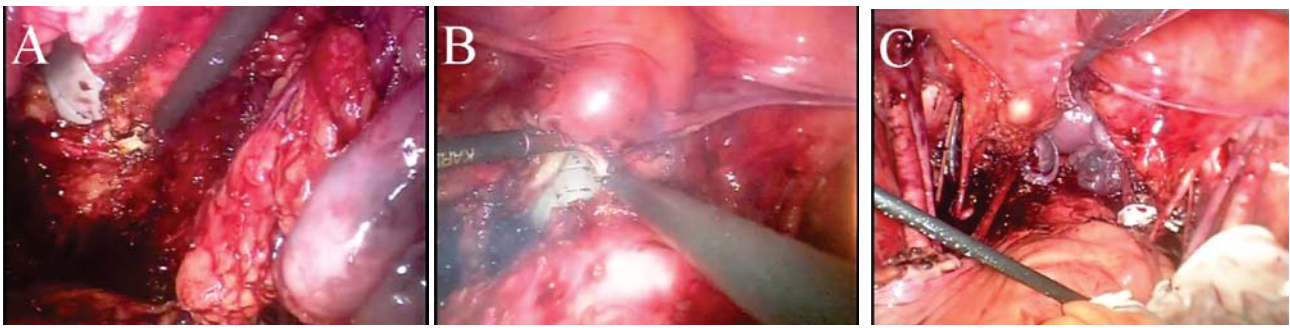


Figure 9 - (A and B) Sectioning of the posterior and anterior walls of the vagina, with a manipulator with a cone to prevent air leakage. **(C)** Removal of the uterus through the vagina, with the bag containing the lymphadenectomy specimens ready to be removed immediately after.

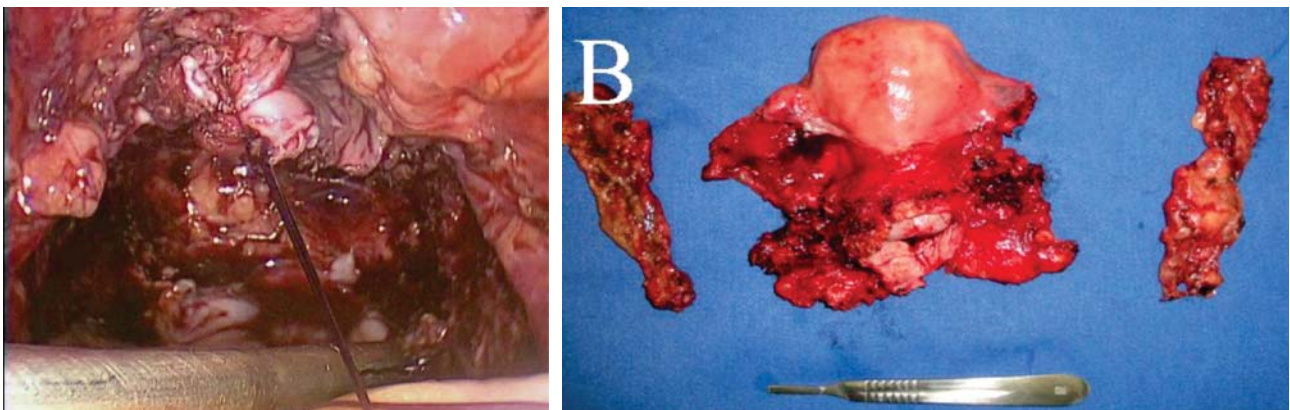


Figure 10 - (A) Suturing of the left angle of the vagina with cross sutures. **(B)** The surgical specimen from radical hysterectomy with the lymphadenectomies.

The laparoscopic suturing of the vagina requires the obliteration of the vagina to prevent the escape of gas. For oncologic reasons, the uterus should not be left in the vagina. The suturing can be performed with simple interrupted, cross sutures, or continuous sutures, preferably with slowly absorbed absorbable 0 monofilament.

The closure of the pelvic peritoneum is not necessary, and may be associated with an increased risk of febrile morbidity in the postoperative period and lymphocysts, as seen in an open surgery study.²⁰

Once the surgery is completed, lavage and thorough review of the cavity and pelvic structures is performed. The use of drains is not recommended.

The conversion rate of LRH is around 5%. Pellegrino et al in their series of 107 patients operated between 2001 and 2007 required conversion in 6 patients (5.6%).⁶ In three cases conversion was due to the presence of bulky lymph node metastases; the other three were due to the presence of a large quantity of adhesions.

OVARIAN TRANSPOSITION

For patients with cervical cancer who are premenopausal, preservation of the ovaries (Figure 11) and their transposition out of the pelvis is recommended. After performing the hysterectomy, the transposition begins with the detachment of the gonadal vessels. This detachment is extended long enough so that the ovary can be positioned outside the pelvis, preferably near the lower pole of the ipsilateral kidney in the parietocolic gutter. The ovaries are then clipped or sutured to the peritoneum.

The placement of clips, in addition to anchoring the ovaries, allows their identification by a radiation oncologist, so that radiotherapy fields can be planned in order to protect the ovaries.

RADICAL HISTERECTOMY WITH NERVE PRESERVATION (RHNP)

Bladder dysfunction can affect up to 80% of patients who have undergone Piver III radical

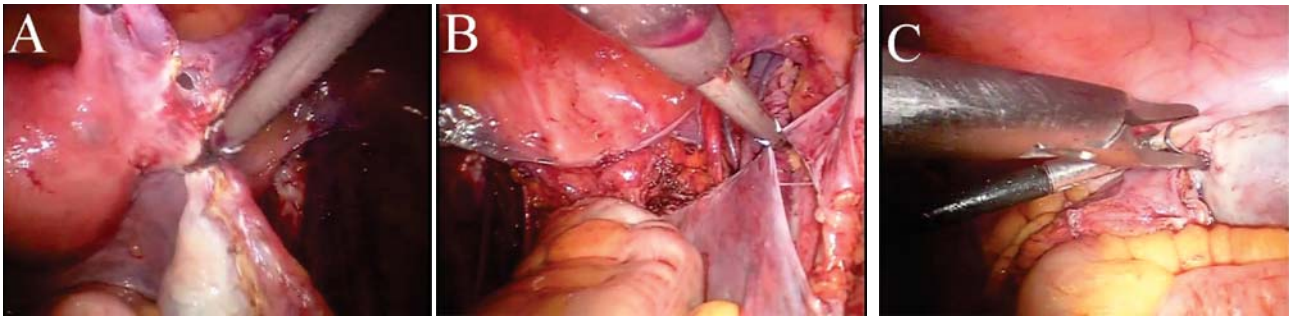


Figure 11 - (A) Sectioning of the right utero-ovarian ligament to preserve the ovary. **(B)** Mobilization of the right ovary by sectioning the peritoneum that invests the gonadal vessels, after removal of the uterus. **(C)** Suturing of the right ovary in the right parietocolic gutter with clips.

hysterectomies.¹¹ This obstacle to radical surgery has generated great interest in the preservation of autonomic innervation of the bladder. Japanese surgeons were the pioneers in the study of innervation and preservation of autonomic innervation of the bladder. They were the first to divide the cardinal ligament in two parts: the vascular part and “neural” part, making the sectioning of the cardinal ligament one of the critical moments of the nerve-sparing radical hysterectomy.¹² This concern with preserving the autonomic innervation of the bladder while maintaining the curability of radical surgery is called the “Tokyo method”.

In general, the nerve-sparing surgery proceeds identically to the surgery without nerve preservation until the dissection of the pararectal space, where the hypogastric nerve is situated near the rectum and runs parallel to the uterosacral ligament.¹³ The peritoneum is incised longitudinally along the uterosacral ligament, with the hypogastric nerve plexus identified under the peritoneum.

The nerve is isolated and retracted laterally to then proceed with the dissection of the colorectal space. Next, the uterine artery is ligated and sectioned at its origin.

The distal stump of the artery is lifted dissected from the connective tissue of the ureter, which then will release the superficial layer of the cardinal ligament. The ureter is freed up to where it enters the vesico-cervical ligament.

Traction on the hypogastric nerve and its dissection up to the cardinal ligament will guide the identification of the pelvic splanchnic nerve. The two unite to form the inferior hypogastric plexus, which along the posterior surface of the uterus gives rise to uterine and bladder branches of this plexus. After identification of the bladder branch, it can be dissected

and preserved even with the radical resection of the paracervix.

In terms of outcomes, the mean number of days that elapse before post-void residual urine volumes (after catheter removal) are less than 50 ml, is about 50% shorter for patients undergoing NSRH (7.4 versus 16.5 days).¹⁴ The return of urinary function for Stages 0 and I is close to 90% with nerve-sparing surgery and is 70% without nerve preservation.¹

NSRH proved safe and effective in the context of cancer of the cervix and may be considered a less morbid alternative for patients who are candidates for radical hysterectomy.¹⁵

MODIFIED RADICAL HISTERECTOMY (MRH)

The MRH consists of the removal of the uterus and parametria at a position just medial to where they cross the ureters. It is often said that the MRH is equivalent to the Piver class II Extended Hysterectomy,⁹ as described by the author himself: “The Class II extended hysterectomy is a moderately extended radical hysterectomy. The purpose is to remove more paracervical tissue, while still preserving the blood supply to the distal ureter and the bladder. The ureters are released from their paracervical position, but are not dissected from pubo-vesicular ligament. Ligation of the uterine vessels just medial to the ureters ensures the preservation of the distal ureteral blood supply.”⁹ (Figure 12) The preservation of periureteral tissue reduces ureteral ischemia-related complications such as fistulas and stenosis. Moreover, the complications related to autonomic nerve injury of the bladder (see NSRH above) are reduced.

Likewise, in the MRH the resection of the vagina need not be so extensive, with the removal of

1 to 2 cm of the distal vagina sufficient for early stage tumors.¹⁶

POST-OPERATIVE CARE

Patients can eat as soon as they recover from anesthesia. Early ambulation should be encouraged, and physical and respiratory therapy provided as well. As soon as the patient is eating normally and has their pain adequately controlled with an oral analgesic – usually by the first or second post-operative day – they can be discharged. It is important to educate patients about the signs that may suggest complications so that they can return promptly to the hospital.

After radical hysterectomy the catheter should be kept in place for 5 to 7 days, and the patient should be instructed how to transition to self-catheterization. Measuring the post-void residue is important for determining when bladder function returns and self-catheterization can be discontinued.

DISCUSSION

Patients with FIGO clinical stage IA2 or IB1 cervical cancer should be treated with radical hysterectomy with pelvic lymphadenectomy – also known as the Wertheim-Meigs operation – with or without adjuvant radiotherapy as indicated by the histopathology findings.^{17,18} The same treatment should be considered for patients with IA1 tumors with invasion of lymphovascular space.¹⁹ The remaining IA1 carcinomas may be treated with a Piver II hysterectomy with pelvic lymphadenectomy.

There is some controversy regarding the appropriateness of radical hysterectomy for patients with stage IB2 tumors. Although surgery alone has never been compared to chemoradiation, the

appearance of superior results with chemoradiation compared to radiotherapy alone led to the favoring of chemoradiation instead of surgery for patients with stage IB2 tumors.²⁰ Minor lesions, but which extend into the vagina (clinical stage IIA) can also undergo radical hysterectomy.

Although currently most agree that MRH should be restricted to the tumors of the cervix not exceeding 2 cm, the MRH can apparently be safely used in more advanced tumors. A randomized study published in 2001 showed comparable results between RH (Piver III) and MRH (Piver II) in terms of overall survival at 5 years (81% versus 77%), cause-specific mortality (18% versus 20%), and 5-year disease-free survival (75% versus 73%).¹⁶ Less radical surgery had a shorter mean surgical time (135 versus 180 minutes) and lower late urinary morbidity (13% versus 28%).

When compared to conventional surgery, LRH results in less blood loss, shorter duration of bladder catheterization, reduced need for opioids, and shorter hospital stays.²¹ Complication rates vary considerably in the literature. A European study of 234 patients had a perioperative mortality of less than 1%; urinary infections occurred in 42%, deep vein thrombosis in 3%, and urinary fistulas in 2%.²² Infections are common in radical hysterectomies. The main causes of fever in the postoperative period are urinary tract, surgical wound, and pelvic infections.^{22, 23}

About 7% of patients undergoing laparoscopic pelvic lymphadenectomy develop lymphocysts.²⁴ Most patients who develop lymphocysts are asymptomatic; major complications are rare.²⁵

Certainly the surgical complications that most challenge surgeons are injuries of the urinary tract, and their associated dysfunctions. Urinary dysfunction – including incontinence or urinary or fecal retention – within the one year of radical hysterectomy, without



Figure 12 - (A) Dissection forceps drawing the left ureter laterally exposing the medial aspect of the ureter in the Modified Radical Hysterectomy. **(B)** Forceps rolling the left ureter laterally distancing it from the heat generated in the sectioning of the parametrium medial to the ureter. **(C)** Left ureter (marked) completely released after sectioning of the parametrium.

nerve sparing, occurs in 70% to 85% of women.²⁶ Bladder dysfunction is attributed to injuries of the motor and sensory innervation of the bladder that occur during resection of the parametrium and the vagina.²⁶ Patients often report difficulty initiating urination, the absence of an urge to void, or incomplete voiding, resulting in recurrent urinary infections.

Bladder fistulas normally develop by the fourth postoperative day, whereas ureteral fistulas usually occur up to the fourteenth post-operative day.

Complications such as atelectasis, deep vein thrombosis, pulmonary embolism, acute myocardial

infarction, pneumonia, among others, are common to all large abdominal or pelvic surgeries.

CONCLUSION

In addition to the benefits in terms of reduced postoperative pain, less blood loss, and earlier resumption of activities, the use of laparoscopic surgery in the treatment of tumors of the cervix has demonstrated its safety in oncologic terms, and therefore should always be considered.

RESUMO

A histerectomia radical continua sendo o tratamento de escolha para a maioria das pacientes com câncer de colo do útero inicial. Vários trabalhos já mostraram a equivalência em termos de controle local e sobrevida com o uso da cirurgia laparoscópica em comparação à técnica aberta. Os benefícios da técnica laparoscópica em comparação à aberta estão baseados nos benefícios gerais da laparoscopia como menor perda sanguínea, menor dor pós-operatória tempo de internação reduzido e menor custo hospitalar, e retorno precoce ao trabalho. Neste artigo descrevemos em detalhes as técnicas de histerectomia radical e linfadenectomia pélvica utilizadas no tratamento do câncer de colo do útero e discutimos os resultados.

Palavras-chave: Histerectomia radical. Linfadenectomia pélvica. Câncer de colo do útero. Laparoscopia.

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