



Radical Vaginal Trachelectomy

27

Suzana Arenhart Pessini, Gustavo Py Gomes da Silveira, and Denis Querleu

Introduction

Cervical cancer is the fourth most common cancer in women, with estimated rates of incidence age standardized (ASRs) ranging from 5.5 per 100,000 in Australia/New Zealand to 42.7 in Eastern Africa. Around 84% of new cervical cancer and 87% of cervical cancer deaths occur in the less developed regions [1].

The peak age of developing cervical cancer is 47 years, and approximately 47% of women with invasive cervical cancer are younger than 35 years of age at diagnosis [2].

The incidence of cervical cancers in young women is increasing. Between 2000 and 2009, the incidence in women aged 20–29 increased annually by an average of 10.3% [3]. Besides that, 14.9% of

the women with cervical cancer are between 20 and 34 years of age, and 26.2% are between 35 and 44 years old [4, 5]. In the USA, about 50% of all fertile women with a diagnosis of early-stage cervical cancer fit the criteria for RVT [6].

Based in these facts, there is no area in which conservative surgery makes more sense than cervical carcinoma, allowing young women to preserve their childbearing potential.

History

Professor Daniel Dargent, from Hôpital Edouard Herriot in Lyon, France, proposed a radical vaginal removal of the cervix, the upper part of vagina, and the proximal part of the parametria (radical vaginal trachelectomy (RVT)) combined with laparoscopic pelvic lymphadenectomy. Dargent started this procedure in 1986 and published his first results in 1994 [7, 8]. Other centers, like Berlin with Achim Schneider, Quebec with Michel Roy and Marie Plant, London with John Sheperd, and Toronto with Allan Covens, adopted and published their experience [9–12]. Professor Denis Querleu, in 1998, included and described this procedure in his book *Techniques Chirurgicales em Ginecologie* [13]. In 2000 Dargent analyzed 47 patients submitted to RVT with median follow-up of 52 months (7–123 months). Recurrences were observed in 2 patients (4.3%), and 20 pregnancies occurred in 13 patients with 10 normal newborn.

Electronic supplementary material The online version of this chapter (https://doi.org/10.1007/978-3-319-72592-5_27) contains supplementary material, which is available to authorized users.

S. A. Pessini, M.D., Ph.D. (✉)
G. P. G. da Silveira, M.D., Ph.D.
Federal do Rio Grande do Sul (UFRGS) and
Universidade Federal de Ciências da Saúde de Porto
Alegre (UFCSA), Porto Alegre, RS, Brazil
e-mail: spessini@terra.com.br

D. Querleu, M.D.
Department of Surgery, Institut Bergonié,
Bordeaux, France

Tumor diameter more than 2 cm and lymphovascular space invasion (LVSI) were the most important risk factors for recurrence [14]. In Brazil, the first RVT was performed by our group, from Santa Casa Hospital, Porto Alegre, in 2000.

Indications

The first condition is for the patient to desire to preserve fertility.

The other criteria are epidermoid, adenocarcinoma, or adenoescamoso histology; stages IA1 with LVSI, IA2, and IB1 up to 2 cm in size; invasion of the connective tissue of less 10 mm; negative lymph nodes; and 5 mm clear margin after resection.

For patients with early-stage cervical cancer who desire fertility preservation, radical trachelectomy (vaginal, abdominal, or laparoscopic) and pelvic lymphadenectomy are considered a standard treatment.

Preoperative

The criteria for the indications must be followed.

For the clinical staging, a pelvic examination provides the dimensions and the parametrial status. X-ray examination of the lungs and pyelography or ultrasound of the renal tract is recommended by FIGO. Cystoscopy and proctoscopy are used for more advanced stages. Blood tests should include full blood count and renal and liver functions, and syphilis and HIV serology need to be considered. Magnetic resonance imaging (MRI) is the best technique to show tumor size, depth of stromal invasion, and distance between the superior part of the tumor and internal os [15, 16].

For detecting lymph node metastatic disease, the most precise method is sentinel node. Computed tomography (CT), MRI, and positron-emission tomography (PET) have low precision [17].

Cone biopsy for precise diagnosis is important to some authors [18].

Technique

The abdomen and pelvis are carefully examined at the beginning of the operation by inspection of the peritoneal cavity, including a detailed examination of the fallopian tubes and ovaries. Frozen section of any suspicious peritoneal or ovarian growth, or of enlarged nodes, is required before starting the procedure, which must be abandoned in case of metastatic disease.

A laparoscopic pelvic lymphadenectomy is performed prior to the trachelectomy procedure. Identification of sentinel lymph node following intracervical injection of radiocolloid, blue dye, or fluorescence-emitting indocyanine green is the first step of the procedure. Pelvic nodes from the common iliac bifurcation proximally to the circumflex vein distally, including the pelvic nodes from the external iliac, internal iliac, and obturator regions, are then removed. The fertility-sparing procedure is abandoned, and a para-aortic lymph node sampling is performed if positive nodes are found. Only negative node patients are candidates for radical trachelectomy.

Vaginal Trachelectomy (Dargent Operation) (Movie from Denis Querleu)

The procedure begins with delineating an adequate vaginal margin of approximately 1–2 cm. Six or eight Kocher's forceps are placed circumferentially, and dilute epinephrine solution is injected under the vaginal mucosa to reduce bleeding and facilitate dissection. The vaginal mucosa is incised; the anterior and posterior aspects of the vaginal incision are folded together using Krobach clamps placed horizontally. The posterior cul-de-sac is opened posteriorly, the rectovaginal space is created, and the rectovaginal ligament is divided. The specimen is then

pulled downward, and the vesicouterine space is entered and developed by blunt dissection. The most tricky and specific part of radical vaginal surgery, which is the identification and dissection of the pelvic ureters, can be undertaken. The ureters are located within the so-called bladder pillar that is a structure defined by the vesicouterine space medially and the paravesical space laterally on each side. The paravesical spaces must then be widely opened in order to delineate the bladder pillar. Once the prevesical and paravesical spaces are developed, the ureter can be palpated and then dissected within the midportion of the bladder pillar. The uterovesical ligament can then be transected distal to the ureter. The lateral parametrium (paracervix) is clamped or coagulated and divided. Only the descending branch of the uterine artery, the cervicovaginal branch, is coagulated or ligated and divided without disturbing the main blood supply to the uterus. The cervix is transected ideally 1 cm below the internal cervical os and 1 cm above the upper limit of the tumor. A frozen section of the superior margin of the cervix can be performed to ensure safe negative endocervical margins. When the clear margin is less than 5 mm, removing another 3–5 mm of the residual cervix is recommended to improve tumor clearance. After ensuring that a proper oncological surgery with sufficient margins is obtained, the reconstruction is carried out. A prophylactic permanent cerclage is placed at the level of the internal os to avoid cervical incompetence. Finally, the cervical stump is sutured to the vaginal mucosa at a distance from the internal os.

Abdominal Radical Trachelectomy

To complete an abdominal radical trachelectomy, radicality is ensured by dividing the cardinal ligaments after dissection of the ureters. The preservation of the uterus and adnexa is made possible by refraining from dividing the upper pedicles of the uterus. After the vaginal incision and the division of cardinal ligament at the appropriate level, the cervix is divided and then

sutured to the vaginal wall after placement of a permanent cerclage. The rest is similar to the equivalent steps of radical hysterectomy. The preservation of uterine arteries is more difficult than it is from below. The uterine arteries can be carefully preserved or repaired after division. However, the benefit of preserving the uterine arteries is not clear [19].

Laparoscopic or Robotic-Assisted Radical Trachelectomy

The laparoscopic or robotic-assisted operation mimics the abdominal operation. The surgery may involve a vaginal step for the excision of the specimen after division of the cardinal surgery, the placement of cervical cerclage, and for the completion of the uterovaginal anastomosis.

Postoperative Care and Complications

A Foley catheter is placed in all patients for 48 h after the procedure. Postoperative bladder function is assessed at day 2 by measuring the post-void residual urine volume. If it is higher than 50 mL, the residual urine volume is measured after each miction and is stopped when obtaining two post-void residual urine volumes of less than 100 mL or one post-void residual urine volume less than 50 mL. In cases of urinary retention, patients are discharged with home self-intermittent catheterization.

Complications and Morbidity

The most common perioperative morbidities are bleeding and urinary tract injuries (1.7 and 1.6%). Postoperative morbidities are lymphocytosis, lymphedema, dyspareunia, menstrual disorders, and cervical stenosis [20, 21]. Cervical stenosis is a specific postoperative complication, with incidence of 8.1% in

RVT, less than abdominal and laparoscopic route [22].

Oncological Results

A recent systematic review, from Institute Gustave Roussy group, Villejuif, France [20], analyzed six different fertility-sparing surgery approaches for patients with cervical cancer. Dargent's procedure was identified in 1523 patients from 21 series. The recurrence was 3.8% (58/1523), and 24 patients died from the disease (1.6%).

In other publications, the 5-year recurrence and mortality rates are 2–6% and 1.6–6% [21, 23–26], comparable to classical radical abdominal hysterectomy. Another review, with 1293 radical trachelectomy, identified recurrence risk range of 0–16.8% [27]. Hauerberg et al. [28] observed 5.1% of recurrence, 10.5% in women with adenocarcinoma, and 2.5% in women with epidermoid.

The pattern of cancer recurrence in 10/320 (3.1%) patients treated with RVT was described by Mangler et al. [29]. Recurrence appeared at a mean time of 26.1 months (3–108), and five patients (1.6%) died within 8.8 months (4–15). None of the ten patients showed significant high-risk factors, which concluded there seems to be no pattern in the recurrence after RVT.

Fertility and Obstetric Outcomes

Speiser et al. [26] suggest possible changes caused by surgery that might influence fertility: cervical mucus reduced or altered, cervical stenosis, adhesions, and reduced blood flow.

The pregnancy rate, determined from series with complete data and based on total number of patients attempting to become pregnant and the number succeeding, is 63%. Pregnancies occurred in 487/1523 patients (32%), fetal loss in 103/487 (21%), and preterm delivery in 104 (21.3%) [20].

According to Speiser et al. [30], most patients were not planning a pregnancy after fertility-sparing surgery. From 212 patients treated by them, only 76 (35.8%) were planning after

0–5 years follow-up surgery, and 50/76 (65.8%) were pregnant. The pregnancy rate for all patients was 24% (50/212), but the really important rate, which shows the true success, is referred to how many patients would like to be pregnant after surgery (65.8%). Fifty women had 60 pregnancies and 45 live births (75%).

Second-trimester miscarriage and severe prematurity before 32 weeks are related to trachelectomy. The main reason of preterm delivery is premature rupture of the amniotic membranes [26, 27, 31].

Personal Experience

It seems that the first radical trachelectomy in Brazil was performed by our group in 2000. Until 2016, 26 patients were eligible, and 8 were excluded (4 by positive sentinel node, 3 by involvement of the up cervical channel, and 1 by neuroendocrine histology). From 18 patients (25–38 years old) with up to 188 months follow-up, the survival was 94.4%, and the spontaneous pregnancy rate was 83%, with 50% third-trimester deliveries and baby at home.

Careful Pregnancies

A minimum of 3 months seems a good interval between surgery and the first attempt to conceive [17].

All pregnancies must be considered high-risk pregnancies and the delivery cesarean section be done in a reference center with perinatology unit.

During pregnancy, the team of Charles University, Prague, recommends cephalosporin antibiotics at weeks 16, 20, and 24 and clindamycin vaginal treatment to prevent intraovular infection at weeks 16 and 20 [17]. Other authors prefer prophylactic use of oral metronidazole during weeks 15–21 and sexual abstinence during the second and third trimesters [32].

Speiser et al. [26] suggest to avoid elective dental treatment, by the bacteremia risk; vaginal intercourse between 14 and 34 weeks of gestation, by urinary and vaginal infection risk; and digital vaginal examinations.

Abdominal cerclage should be offered—by laparoscopy if not pregnant and by laparotomy if pregnant [26].

Prognostic Factors

Neuroendocrine tumors, tumor size more than 2 cm, and LVSI are the most important factors associated with recurrence and death [14, 25].

The analysis of 1523 patients submitted to RVT, those with IB1 tumors more than 2 cm had 17% recurrent disease, and those with IB1 up to 2 cm had 4% ($p = 0.001$) [20].

The LVSI data are more difficult to analyze, because some series did not mention this factor. From 473 patients with tumors up to 2 cm with details on LVSI or not, the recurrence was 5 and 7% ($p = 0.15$) [20].

Follow-Up

Review every 3 months for the first 2 years after surgery and then every 6 months for the next 3 years. After 5 years, annual follow-up [26].

Conclusion

Fertility-sparing surgery for cervical cancer must be offered to patients who desired to conceive, with respect to the criteria.

Cervical cancer occurs in young women, and they become pregnant more and more before age 30. Sonoda et al., from Memorial Sloan Kettering Cancer Center, New York, identified that 48% of patients who undergone radical hysterectomy between 1985 and 2001 may have been eligible by fertility-sparing surgery [6].

RVT with laparoscopic lymphadenectomy seems the standard fertility-sparing procedure for the cervical cancer patients [11].

Although there are no randomized controlled trials regarding oncological outcomes, because it's not feasible for women who wish to preserve fertility, many studies show similar rates of survival and recurrence in RVT compared with radical hysterectomy.

References

1. IARC. International Agency for Research on Cancer. <https://www.iarc.fr>.
2. Gattoc L, Viswanathan AN, Perez CA, Tew WP, Makhija S. Cervical cancer. Cancer management. Cancernetwork 2015. <http://www.cancernetwork.com/cancer-management/cervical>.
3. Patel A, Galaal K, Burnley C, Faulkner K, Martin-Hirsch P, Bland MJ, Leeson S, Beer H, Paranjothy S, Sasieni P, Naik R. Cervical cancer incidence in young women: a historical and geographic controlled UK regional population study. *Br J Cancer*. 2012;106:1753–9.
4. Covens A, Rosen B, Murphy J, Laframboise S, DePetrillo AD, Lickrish G, Colgan T, Chapman W, Shaw P. Changes in demographics and perioperative care of stage IA2 IB1 cervical cancer over the past 16 years. *Gynecol Oncol*. 2001;81:133–7.
5. Quinn MA, Benedet JL, Odicino F, Maisonneuve P, Beller U, Creasman WT, Heintz AP, Ngan HY, Pecorelli S. Carcinoma of the cervix uteri. FIGO 26th annual report on the results of treatment in gynecological cancer. *Int J Gynaecol Obstet*. 2006;95:43–103.
6. Sonoda Y, Abu-Rustum NR, Gemignani ML, Chi DS, Brown CL, Poyner EA, Barakat RR. A fertility-sparing alternative to radical hysterectomy: how many patients may be eligible? *Gynecol Oncol*. 2004;95:534–8.
7. Dargent D, Brun JL, Remy I. Pregnancies following radical trachelectomy for invasive cervical cancer. Society of Gynecologic Oncologists. *Abstr Gynecol Oncol*. 1994;52:105–8.
8. Dargent D, Brun JL, Roy M, Mathevet P, Remy I. La trachelectomie élargie (TE), une alternative à l'hystérectomie radicale dans le traitement des cancers infiltrants développés sur la face externe du col utérin. *JOBGYN*. 1994;2:2859–92.
9. Covens A, Shaw P. Is radical trachelectomy a safe alternative to hysterectomy for early stage IB carcinoma of the cervix. Society of Gynecologic Oncologists. *Abstr Gynecol Oncol*. 1999;72:443–4.
10. Roy M, Plante M. Pregnancies after radical vaginal trachelectomy for early-stage cervical cancer. *Gynecol Oncol*. 1996;62:336–9.
11. Schneider A, Drause N, Kuhne Heid R, et al. Erhaltung des Fertilität bei frühen Zervix Karzinom: Trachelektomie mit laparoskopischer lymphonodektomie. *Zentralbl Gynakol*. 1996;118:6–8.
12. Sheperd JH, Crawford R, Oram D. Radical trachelectomy: a way to preserve fertility in the treatment of early cervical cancer. *Br J Obstet Gynaecol*. 1998;105:912–6.
13. Querleu D. *Techniques Chirurgicales em Ginecologie*. 2nd ed. Ed Masson; 1998.
14. Dargent D, Martin X, Sacchetoni A, Mathevet P. Laparoscopic vaginal radical trachelectomy. A treatment to preserve the fertility of cervical carcinoma patients. *Cancer*. 2000;88:1877–82.

15. Bermudez A, Bhatla N, Leung E. Cancer of the cervix uteri. *Int J Gynecol Obstet.* 2015;131:S88–95.
16. Lakhman Y, Akim O, Park KJ, Sarasohn DM, Zheng J, Goldman DA, Sohn MJ, Moskowitz CS, Sonoda Y, Hricak H, Abu-Rustum NR. Stage IB1 cervical cancer: role of preoperative MR imaging in selection of patients for fertility-sparing radical trachelectomy. *Radiology.* 2013;269:149–58.
17. Halaska MJ, Robova H, Pluta M, Rob L. The role of trachelectomy in cervical cancer. *Ecanermedicalscience.* 2015;9:506.
18. Uzan C, Gouy S, Desroque D, Pomel C, Duvillard P, Balleyguier C, Haie-Meder C, Morice P. Analysis of a continuous series of 34 young patients with early-stage cervical cancer selected for a vaginal radical trachelectomy: should “staging” conization be systematically performed before this procedure? *Int J Gynecol Cancer.* 2013;23:331–6.
19. Tang J, Li J, Wang S, Zhang D, Wu X. On what scale does it benefit the patients if uterine arteries were preserved during ART? *Gynecol Oncol.* 2014;134:154–9.
20. Bentivegna E, Gouy S, Maulard A, Chargari C, Leary A, Morice P. Oncological outcomes after fertility-sparing surgery for cervical cancer: a systematic review. *Lancet Oncol.* 2016;17:240–53. www.thelancet.com/oncology.
21. Schneider A, Erdemoglu E, Chiantera V, Reed N, Morice P, Rodolakis A, Densclag D, Kesic V. Clinical recommendation radical trachelectomy for fertility preservation in patients with early-stage cervical cancer. *Int J Gynecol Cancer.* 2012;22:659–66.
22. Li X, Li J, Wu X. Incidence, risk factors and treatment of cervical stenosis after radical trachelectomy: a systematic review. *Eur J Cancer.* 2015;51:1751–9.
23. Dursun P, Leblanc E, Nogueira MC. Radical vaginal trachelectomy (Dargent’s operation): a critical review of the literature. *Sur Surg Oncol.* 2007;33:933–41.
24. Lanowska M, Mangler M, Spek A, Grittner U, Hasenbein K, Chiantera V, Hertel H, Schneider A, Köhler C, Speiser D. Radical vaginal trachelectomy (RVT) combined with laparoscopic lymphadenectomy; prospective study of 225 patients with early-stage cervical cancer. *Int J Gynecol Cancer.* 2011;21:1458–64.
25. Plante M, Gregoire J, Renaud MC, Roy M. The vaginal radical trachelectomy: na update of a series of 125 cases and 106 pregnancies. *Gynecol Oncol.* 2011;121:290–7.
26. Speiser D, Köhler C, Schneider A, Mangler M. Radical vaginal trachelectomy. *Dtsch Arztebl Int.* 2013;110:289–95.
27. Gizzo S, Ancona E, Saccardi C, Patrelli TS, Berreta R, Anis O, Noventa M, Bertocco A, Fagherazzi S, Longone M, Vendemiati L, D’Antona D, Nardelli GB. Radical trachelectomy: the first step of fertility preservation in young women with cervical cancer (review). *Oncol Rep.* 2013;30:2545–54.
28. Hauergerg L, Hogdall C, Loft A, Bjoern SF, Mogaard BJ, Nedergaard L, Lajer H. Vaginal radical trachelectomy for early stage cervical cancer. Results of the Danish National Single Center Strategy. *Gynecol Oncol.* 2015;138:304–10.
29. Mangler M, Lanowska M, Köhler C, Vercellino F, Schneider A, Speiser D. Pattern of cancer recurrence in 320 patients after radical vaginal trachelectomy. *Int J Gynecol Cancer.* 2014;24:130–4.
30. Speiser D, Mangler M, Köhler C, Hasenbein K, Hertel H, Chiantera V, Gottschalk E, Lanowska M. Fertility outcome after radical vaginal trachelectomy. A prospective study of 212 patients. *Int J Gyn Onc.* 2011;21:1635–9.
31. Sheperd JH. Challenging dogma: radical conservation surgery for early stage cervical cancer in order to retain fertility. *Ann R Coll Surg Engl.* 2009;91:181–7.
32. Perrson J, Imboden S, Reynisson P, Andersson B, Borgfeldt C, Bossmar T. Reproducibility and accuracy of robot-assisted laparoscopic fertility sparing radical trachelectomy. *Gynecol Oncol.* 2012;127:484–8.