Morbidity of Staging Inframesenteric Paraaortic Lymphadenectomy in Locally Advanced Cervical Cancer Compared With Infrarenal Lymphadenectomy

Clothilde Petitnicolas, MD, Henri Azaïs, MD,† Louise Ghesquière, MD,† Emmanuelle Tresch-Bruneel, MSc,‡ Abel Cordoba, MD,§ Fabrice Narducci, MD,* Lucie Bresson, MD,* and Eric Leblanc, MD**

Objective: Extended-field chemoradiation is typically used for the management of patients with locally advanced cervical cancer. Given the low rate of skipped metastases above the inferior mesenteric artery, ilioinframesenteric dissection seems to be an acceptable pattern of paraaortic lymph node dissection (LND). Our objective is to compare the surgical morbidity of inframesenteric LND (IM-LND) with infrarenal LND (IR-LND).

Methods: In our center, all of the patients with locally advanced cervical cancer and negative magnetic resonance imaging and positron emission tomography–computed tomography imaging at the paraaortic level were offered laparoscopic staging including a diagnostic laparoscopy followed, if negative, by an extraperitoneal paraaortic lymphadenectomy. From January 2011 to September 2015, we included patients who had paraaortic LND from both common iliac bifurcations and divided them into 2 groups according to dissection pattern: to the inferior mesenteric artery (IM-LND) level or to the left renal vein (IR-LND) level. The perioperative and postoperative data were retrospectively recorded.

Results: A total of 119 women were included in our study: 56 in the IM-LND group and 63 in the IR-LND group. There was no difference in the patients' characteristics between groups. Regarding the surgical procedure, the operating time was shorter in the IM-LND group than the IR-LND group, 174 ± 50 minutes versus 209 ± 61 minutes ($P = 0.001$), respectively. There was no significant difference in intra- and postoperative complications, overall survival, or progression-free survival.

Conclusions: In our series, exclusive IM-LND surgery is faster than IR-LND and results in similar morbidity and survival rates. These results confirm the feasibility and the applicability of IM-LND to simplify the surgical procedure without impacting survival. More patients should be included in the study to demonstrate the lower rate of morbidity.

Key Words: Cervical cancer, Paraaortic lymphadenectomy, Laparoscopy, Morbidity

Received October 5, 2016, and in revised form November 17, 2016.
Accepted for publication December 6, 2016.

(*Int J Gynecol Cancer* 2017;27: 575–580)

*Department of Gynecological Oncology Surgery, Centre de Lutte Contre le Cancer Oscar Lambret, Lille Cedex; †Department of Gynecology, Hôpital Jeanne de Flandre, CHRU Lille; and Departments of ‡Statistics and §Radiation Oncology, Centre de Lutte Contre le Cancer Oscar Lambret, Lille Cedex, France.

Address correspondence and reprint requests to Clothilde Petitnicolas, MD, Department of Gynecological Oncology Surgery, Centre de Lutte Contre le Cancer Oscar Lambret, 3 rue Combemale, 59020 Lille Cedex, France. E-mail: clothilde.petitnicolas@hotmail.fr.

The authors declare no conflicts of interest.

ISSN: 1048-891X
DOI: 10.1097/IGC.0000000000000921

Cervical cancer is one of the most common cancers in women.[1] Mortality represents approximately 50% of more than 500,000 cases per year, and its incidence varies widely among countries, being more frequent in Africa, with world age-standardized rates ranging from less than 1 to greater than 50 per 100,000.[2] Cervical cancer, more than other major cancers, affects young women.[2]

Treatment depends on the tumor stage, based on the International Federation of Gynecology and Obstetrics (FIGO) classification.[3] A tumor measuring larger than 4 cm without distant metastasis generally defines locally advanced cervical cancer (LACC).[4] Pelvic or extended-field chemoradiation is the typical treatment for these patients,[5,6] depending on positive paraaortic nodes that represent approximately 15% in locally advanced cancer.[7] The most appropriate management approach is generally determined by a multidisciplinary committee after performing paraaortic staging using positron emission tomography–computed tomography (PET-CT), and if the result is negative at this level, by using a laparoscopic approach before chemoradiation.[8] If lymphadenectomy is necessary, it is because of the low sensitivity of PET-CT in the detection of low-volume nodal metastasis (nearly 34% for microscopic metastases[9]) despite its high specificity and good rate of detection of paraaortic disease.[10,11]

Paraaortic lymphadenectomy is defined by the removal of nodes located in the common iliac nodes up to the left renal vein. There is ongoing debate among surgeons regarding limiting the removal of nodes to the inframesenteric artery, to the right gonadal vein, or to the left renal vein.[12–14] Given the very low rate of skipped metastases above the inferior mesenteric artery (IMA),[7] ilioinframesenteric dissection should be an acceptable pattern of paraaortic lymph node dissection (LND). Indeed, in cervical cancer, we believe that nodal metastases evolve step by step via the lymphogenous route in an orderly fashion.[15]

In our center, we decided to stop at the IMA to avoid morbidity related to this staging and reduce our operating time. Morbidity is particularly related to complications that may occur during or after surgery and may induce a longer hospitalization and delay treatment. Our objective was to compare the surgical morbidities of inframesenteric LND (IM-LND) and infrarenal LND (IR-LND).

MATERIALS AND METHODS

Study Design

This retrospective historical study was conducted from January 2011 to June 2015 in the gynecological oncology department of our center.

Inclusion and Exclusion Criteria

All of the patients diagnosed with LACC, stage IB2 or higher of the FIGO, and who had paraaortic LND were included in the study. The patients referred for treatment to our center after staging surgery were excluded from the study. Paraaortic LND was proposed when magnetic resonance imaging (MRI) and PET-CT imaging were negative at the paraaortic level. First, occult carcinomatosis was ruled out by diagnostic transperitoneal laparoscopy. Then, LND included the removal of all lateroaortic, preaortic, interaortocaval, precaval, and laterocaval nodes. According to the dissection patterns, the patients were assigned to the IM-LND group if dissection started from both common iliac bifurcations to the level of IMA or to the IR-LND group if dissection started from both common iliac bifurcations to the level of the left renal vein. Patients were assigned to the IR-LND group from 2011 to 2013 and to the IM-LND group from 2014 to 2015. The decision in favor of the change of landmarks in 2014 was driven by a previous study on paraaortic dissection rules.[7]

Surgical Technique

The left extraperitoneal route was used as previously decribed.[16,17] Dissection was performed using bipolar forceps and LigaSure sealing. Except for signaling the upper level of dissection in IR-LND, clips were not used systematically but in accordance to the choice of the surgeon.

Population Characteristics

We identified the patients from our database, Clinsight, and we collected anonymous data using computerized medical records. The perioperative data were retrospectively recorded.

The patients' characteristics were extracted to compare the groups according to age, body mass index, comorbidities, notable smoking, and performance status in the World Health Organization score. Tumor features were recorded according to size, histological grade, FIGO stage, and lymphovascular space invasion. The following surgical details were recorded: amount of bleeding, marsupialization of the retroperitoneum, number of lymph nodes removed, operating time, hospital length of stay, and time between diagnostic of LACC and surgery. Marsupialization consisted of incising the peritoneum to open the retroperitoneal space to prevent lymphocyst formation at the end of the procedure.

Surgical morbidity was divided into intraoperative and postoperative complications, using the Clavien-Dindo scoring system to classify these complications.[18] The intraoperative complications included vascular, bowel, or urinary tract injury, and postoperative complications were represented by lymphatic complications such as lymphocysts and lymphoedema, abdominal wall (abscess and evisceration), neurological injury, fistula, deep abscess, or thromboembolism. Complications were recorded up to 90 days after staging.

Statistics

The patients' characteristics were summarized using the following descriptive methods: means, SDs, medians and ranges for continuous parameters, and frequencies and percentages for categorical parameters. The groups were compared using χ^2 test for categorical variables or Fisher exact test in the case of small counts. Regarding continuous variables, the Student t test was performed if its conditions of application were met. Otherwise, the nonparametric Wilcoxon Mann-Whitney test was used. The distribution of operating times was graphically described using box plots. Survival times were estimated from the date of surgery using the Kaplan-Meier method. The overall survival rate was defined as the time until death due to any cause; patients who survived were censored at the date of last follow-up.

Progression-free survival was defined as the time until relapse or death due to any cause; patients who survived without relapse were censored at the date of the last news. A P value less than 0.05 was considered to be statistically significant. The data were collected in Ennov clinical, a software specifically designed for database management. Statistical analyses were performed using Stata v13.1 (StataCorp LP, College Station, Tex).

RESULTS

A total of 119 women were included in our study from January 2011 to June 2015: 56 in the IM-LND group and 63 in the IR-LND group.

Concerning the patients' characteristics, there was no significant difference between both groups, except for smoking, with 8.9% of smokers in the IM-LND group and 22.2% in the IR-LND group ($P < 0.05$) (Table 1). We also observed that cervical cancer was diagnosed at a median age of approximately 47 years for both groups. The median body mass index was 24.7 kg/m^2 for the IM-LND group and 25.6 kg/m^2 for the IR-LND group ($P = 0.85$). Among tumor types, the most frequent histologic subtype was squamous carcinoma, with 75.0% in the IM-LND group and 69.8% in the IR-LND group; glandular carcinoma was noted, with 21.4% in the IM-LND group and 23.8% in the IR-LND group ($P = 0.80$). The maximal MRI tumor size was also evaluated with a median of 50 mm documented in both groups (Table 1).

Regarding the surgical procedure, the operating time was shorter in the IM-LND group compared with the IR-LND group, 174 ± 50 minutes versus 209 ± 61 minutes ($P = 0.001$), respectively, and marsupialization was most frequent in the IM-LND group (67.0% vs 49.2%, $P = 0.04$) (Fig. 1 and Table 2). Median number of lymph nodes dissected was 13 (4–37) in the IM-LND group and 21.5 (9–46) in the IR-LND group

TABLE 1. Preoperative characteristics of patients and their tumor

	IM-LND N = 56 (%)	IR-LND N = 63 (%)	*P*
Median age, y (range)	47.5 (28–73)	47 (30–72)	0.59
Median body mass index (range)	24.7 (15.9–53.8)	25.6 (17.8–49.5)	0.85
Comorbidity	21 (37.5)	34 (54.0)	0.07
Smoking	5 (8.9)	14 (22.2)	<0.05
Other cancer	2 (3.6)	2 (3.2)	1.00
Cardiovascular	10 (17.9)	16 (25.4)	0.32
Diabetes	2 (3.6)	3 (4.8)	1.00
Neurologic	2 (3.6)	2 (3.2)	1.00
Respiratory	1 (1.8)	3 (4.8)	0.62
Hepatic	—	2 (3.2)	0.50
Others	5 (8.9)	5 (7.9)	0.85
Performance status, World Health Organization score			
0	52 (94.5)	59 (93.7)	
1	3 (5.5)	2 (3.2)	0.50
2	—	2 (3.2)	
Histologic subtype			
Squamous	42 (75.0)	44 (69.8)	
Glandular	12 (21.4)	15 (23.8)	0.80
Others	2 (3.6)	4 (6.4)	
Median MRI tumor size (range)	50 (26–120)	50 (24–80)	0.79
Lymphovascular space invasion	5/21 (23.8)	5/15 (33.3)	0.71
FIGO staging classification			0.31
IA1	1 (1.8)	—	
IB1	5 (8.9)	4 (6.3)	
IB2	17 (30.4	26 (41.3)	
IIB	25 (44.6)	24 (38.1)	
IIIA	2 (3.6)	—	
IIIB	4 (7.1)	7 (11.1)	
IVA	2 (3.6)	—	
IVB	—	2 (3.2)	

TABLE 2. Surgery

	IM-LND N = 56 (%)	IR-LND N = 63 (%)	*P*
Bleeding >0 mL, *n* (%)	16 (28.6)	25 (39.7)	0.20
Median volume, mL (range)	100 (10–3500)	100 (100–200)	0.06
Marsupialization, *n* (%)	38 (67.0)	31 (49.2)	0.04
Median of total lymph nodes removed, *n* (range)	13 (4–37)	22 (9–46)	<0.001
Total procedure operating time, min			
• Median (range)	175 (90–330)	188 (90–390)	0.001
• Mean (SD)	174 ± 49	209 ± 61	
Median hospital stay after surgery, d (range)	2 (1–22)	2 (1–8)	0.81
Mean time between diagnostic and surgery, mo (SD)	2.6 ± 8.4	2.5 ± 6.7	0.91

($P < 0.001$). There was no significant difference between both groups for hospital stay, blood losses, or delay between diagnostic and surgery (Table 2). All of the surgeries were performed by laparoscopy, and no conversion to laparotomy was required.

There was no significant difference concerning the rate of intra- and postoperative complications or the severity of the complications (Table 3). Eighteen patients (32.1%) had intra- and postoperative complications in the IM-LND group and 19 (30.2%) in the IR-LND group ($P = 0.82$). However, when 1 grade IIIB complication was diagnosed in the IM-LND group, 1 grade IV and 5 grade IIIB complications were observed in the IR-LND group. There were also few intraoperative complications with only 1 vascular injury in the IM-LND group and 4 vascular injuries in the IR-LND group. There was no urinary tract or bowel injury. The most frequent complication was lymphocysts with 12 (21.4%) of 56 patients in the IM-LND group and 13 (20.6%) of 63 patients in the IR-LND group ($P = 0.92$). Among these patients, 7 (12.5%) needed drainage of the lymphocyst, corresponding to grade IIIA or higher, in the IM-LND group and 11 (17.5%) in the IR-LND group ($P = 0.45$). For these 18 patients, no delayed treatment was found compared with all other patients ($P = 0.64$).

Nine deaths (16.1%) and 18 recurrences (32.1%) were observed in the IM-LND group and 11 deaths (17.5%) and 22 recurrences (34.9%) in the IR-LND group. There was no significant difference in overall survival (96% vs 95%, respectively; $P = 0.36$) and in progression-free survival (69% vs 73%, respectively; $P = 0.38$) at 1-year follow-up.

DISCUSSION

Comparing the morbidity between patients in the IM-LND and IR-LND groups did not reveal significant differences, whereas a significant reduction in operating time was noticeable in the patients who underwent IM-LND.

The main goal of our study was to evaluate whether lymphadenectomy to the level of the inframesenteric artery could reduce the morbidity of the staging surgery in LACC. A prospective study published in 2016 showed that in only 1 (3.3%) in 30 patients, who had positive nodes after IR-LND, were those nodes exclusively located above the inframesenteric artery.[7] Indeed, the incidence of isolated infrarenal paraaortic lymph node metastases was low because of a stepwise, upward progression of nodal disease in cervical cancer.[15] Our study emphasizes that there is no difference in morbidity between IM-LND and IR-LND, and finally, that the risk/benefit ratio to perform IR-LND is limited.

Operating time reduction was a clear benefit identified in support for IM-LND, with a median of 175 minutes. It is a clear advantage for this staging procedure that would help surgeons to include it in the pretherapeutic evaluation of LACC. In the

TABLE 3. Morbidity data: complications of surgery

	IM-LND N = 56 (%)	IR-LND N = 63 (%)	*P*
Total	**18 (32.1)**	**19 (30.2)**	**0.82**
Clavien-Dindo scoring system			
Grade I	9 (16.1)	6 (9.5)	
Grade II	2 (3.6)	1 (1.6)	0.52
Grade IIIA	6 (10.7)	6 (9.5)	0.33
Grade IIIB	1 (1.8)	5 (7.9)	0.12
Grade IV	—	1 (1.6)	1.00
Intraoperative			
Vascular injury	1 (1.8)	4 (6.4)	0.37
Urinary tract injury	—	—	
Bowel injury	—	—	
Postoperative	18 (32.1)	19 (30.2)	0.82
Lymph			
Lymphocytes	12 (21.4)	13 (20.6)	0.92
Lymphedemas	3 (5.4)	4 (6.3)	1.00
Wall			
Abscess	—	—	
Evisceration	—	1 (1.6)	1.00
Neurologic	4 (7.1)	3 (4.8)	0.71
Fistula/deep abscess	—	2 (3.2)	0.50
Thromboembolism	2 (3.6)	1 (1.6)	0.60

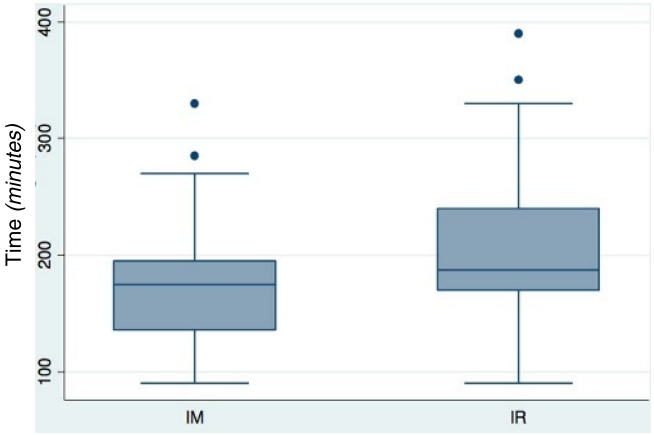

FIGURE 1. Operating time.

literature, operating times are ranged from 80 to 185 minutes,[19–23] which could be consistent with ours because we also included, for nearly every patient, the procedure of bowel radioprotection before pelvic chemoradiation and the placement of a venous access port.

Complications in our study, 32.1% and 30.2%, respectively, occurred more frequently than in other studies. Approximately 21% of all patients were diagnosed with symptomatic lymphocysts, with 18 patients (15%) required drainage corresponding to grade IIIA or higher complication in the Clavien-Dindo classification. Indeed, in the literature, the rates ranged from 7% to 15%[7,8,11,20,23–25] or even 25%[19] for perioperative complications and 8% to 27% for lymphocysts.[8,11,24,25] We considered all of the recorded complications, especially grade I complications, for 9 patients in the IM-LND group and 6 patients in the IR-LND group unlike other studies.[11] Lymphocyst is a common complication of paraaortic LND after extraperitoneal surgery, which is asymptomatic most of the time. But sometimes, lymphocyst drainage is required because of pain, urinary tract obstruction, or infection. Effective treatment of symptomatic lymphocyst is very important to avoid delayed treatment as in our study.

We found same rates of lymphocyst in both groups. Even if a tendance seemed to find more grade IIIA or higher lymphocysts in the IR-LND group, we did not show a significant reduction of the lymphatic morbidity with the reduction of the extent of the dissection. We could also suspect that the cistern, principally the Pecquet cistern, is not concerned by the low dissection, and that the leak of lymph fluid comes from the limb.

The opening of the retroperitoneum by marsupialization can prevent it. This is a part of our daily practice, except when nodes seem to be involved to avoid the risk of carcinomatosis. This preventative approach has been increasingly used recently because there was a significant difference between both groups. Indeed, the inclusion of patients in the IM-LND group was more recent, and the data were better informed. We used other techniques to further reduce lymphocysts such as clips on the largest lymph channels and LigaSure. Harmonic dissection, which has shown efficacy, could also be used.[20,25,26]

Even if these results were not significant in our study, we observed that there were more severe grade IIIB (5 vs 1) and grade IV (1 vs 0) complications in the IR-LND group and more vascular injuries during surgery (4 vs 1). In the IR-LND group, vascular complications often occurred during supramesenteric dissection, and limiting it up to the inframesenteric artery would have avoided these complications.[7]

The main risk of surgical staging is the delay in curative treatment because of surgical morbidity. Staging surgery would have a positive therapeutic effect, with rates of paraaortic recurrence significantly reduced and an effect on overall and progression-free survival.[27] These benefits are more important in patients with involved paraaortic nodes less than 5 mm, which are likely missed by PET-CT.[21]

In our retrospective study, the patients in the IM-LND group were more recently included, with the consequence that we have less time to reach conclusions about recurrence and survival in this group. We do not yet know the 5-year overall and progression-free survival rates because the follow-up duration is too short.

CONCLUSIONS

Staging surgery is important for treatment modification. The IM-LND reduces technical difficulty and operating time compared with IR-LND. There was no difference in terms of morbidity. We must always balance the advantages of staging surgery with its potential morbidity, and surgery should be performed by trained teams. Despite the fact that there was no difference in morbidity in our study, we continue to dissect nodes up to the inframesenteric artery, waiting for future data to give us more information concerning survival and recurrence in these patients and to assess the reduction of morbidity on performing this procedure in a greater number of patients.

REFERENCES

1. GLOBOCAN 2012. Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012. Available at: http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx.
2. Arbyn M, Castellsagué X, de Sanjosé S, et al. Worldwide burden of cervical cancer in 2008. *Ann Oncol*. 2011;22:2675–2686.
3. Pecorelli S, Zigliani L, Odicino F. Revised FIGO staging for carcinoma of the cervix. *Int J Gynecol Obstet*. 2009;105:107–108.
4. Horn LC, Fischer U, Raptis G, et al. Tumor size is of prognostic value in surgically treated FIGO stage II cervical cancer. *Gynecol Oncol*. 2007;107:310–315.
5. Colombo N, Carinelli S, Colombo A, et al. Cervical cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol*. 2012;23:vii27–vii32.
6. Chemoradiotherapy for Cervical Cancer Meta-analysis Collaboration (CCCMAC). Reducing uncertainties about the effects of chemoradiotherapy for cervical cancer: individual patient data meta-analysis. *Cochrane Database Syst Rev*. 2010;CD008285.
7. Leblanc E, Katdare N, Narducci F, et al. Should systematic infrarenal para-aortic dissection be the rule in the pretherapeutic staging of primary or recurrent locally advanced cervix cancer patients with a negative preoperative para-aortic PET imaging? *Int J Gynecol Cancer*. 2016;26:169–175.
8. Köhler C, Mustea A, Marnitz S, et al. Perioperative morbidity and rate of upstaging after laparoscopic staging for patients with locally advanced cervical cancer: results of a prospective randomized trial. *Am J Obstet Gynecol*. 2015;213:503.e1–503.e7.

9. Kang S, Kim SK, Chung DC, et al. Diagnostic value of (18)F-FDG PET for evaluation of paraaortic nodal metastasis in patients with cervical carcinoma: a meta-analysis. *J Nucl Med*. 2010;51:360–367.
10. Leblanc E, Gauthier H, Querleu D, et al. Accuracy of 18-fluoro-2-deoxy-d-glucose positron emission tomography in the pretherapeutic detection of occult para-aortic node involvement in patients with a locally advanced cervical carcinoma. *Ann Surg Oncol*. 2011;18:2302–2309.
11. Gouy S, Morice P, Narducci F, et al. Prospective multicenter study evaluating the survival of patients with locally advanced cervical cancer undergoing laparoscopic para-aortic lymphadenectomy before chemoradiotherapy in the era of positron emission tomography imaging. *J Clin Oncol*. 2013;31:3026–3033.
12. Köhler C, Klemm P, Schau A, et al. Introduction of transperitoneal lymphadenectomy in a gynecologic oncology center: analysis of 650 laparoscopic pelvic and/or paraaortic transperitoneal lymphadenectomies. *Gynecol Oncol*. 2004;95:52–61.
13. Vergote I, Amant F, Berteloot P, et al. Laparoscopic lower para-aortic staging lymphadenectomy in stage IB2, II, and III cervical cancer. *Int J Gynecol Cancer*. 2002;12:22–26.
14. Recio FO, Piver MS, Hempling RE. Pretreatment transperitoneal laparoscopic staging pelvic and paraaortic lymphadenectomy in large (> or = 5 cm) stage IB2 cervical carcinoma: report of a pilot study. *Gynecol Oncol*. 1996;63:333–336.
15. Sakuragi N, Satoh C, Takeda N, et al. Incidence and distribution pattern of pelvic and paraaortic lymph node metastasis in patients with stages IB, IIA, and IIB cervical carcinoma treated with radical hysterectomy. *Cancer*. 1999;85:1547–1554.
16. Dargent D, Ansquer Y, Mathevet P. Technical development and results of left extraperitoneal laparoscopic paraaortic lymphadenectomy for cervical cancer. *Gynecol Oncol*. 2000;77:87–92.
17. Querleu D, Dargent D, Ansquer Y, et al. Extraperitoneal endosurgical aortic and common iliac dissection in the staging of bulky or advanced cervical carcinomas. *Cancer*. 2000;88:1883–1891.
18. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004;240:205–213.
19. Mehra G, Weekes ARL, Jacobs IJ, et al. Laparoscopic extraperitoneal paraaortic lymphadenectomy: a study of its applications in gynecological malignancies. *Gynecol Oncol*. 2004;93:189–193.
20. Gil-Moreno A, Franco-Camps S, Cabrera S, et al. Pretherapeutic extraperitoneal laparoscopic staging of bulky or locally advanced cervical cancer. *Ann Surg Oncol*. 2011;18:482–489.
21. Leblanc E, Narducci F, Frumovitz M, et al. Therapeutic value of pretherapeutic extraperitoneal laparoscopic staging of locally advanced cervical carcinoma. *Gynecol Oncol*. 2007;105:304–311.
22. Sonoda Y, Leblanc E, Querleu D, et al. Prospective evaluation of surgical staging of advanced cervical cancer via a laparoscopic extraperitoneal approach. *Gynecol Oncol*. 2003;91:326–331.
23. Uzan C, Souadka A, Gouy S, et al. Analysis of morbidity and clinical implications of laparoscopic para-aortic lymphadenectomy in a continuous series of 98 patients with advanced-stage cervical cancer and negative PET-CT imaging in the para-aortic area. *Oncologist*. 2011;16:1021–1027.
24. Moore KN, Gold MA, McMeekin DS, et al. Extraperitoneal para-aortic lymph node evaluation for cervical cancer via pfannenstiel incision: technique and peri-operative outcomes. *Gynecol Oncol*. 2008;108:466–471.
25. Gouy S, Morice P, Narducci F, et al. Nodal-staging surgery for locally advanced cervical cancer in the era of PET. *Lancet Oncol*. 2012;13:e212–e220.
26. Rafii A, Camicas A, Ferron G, et al. A comparative study of laparoscopic extraperitoneal lymphadenectomy [correction of laparoscopy] with the use of ultrasonically activated shears. *Am J Obstet Gynecol*. 2009;201:370.e1–370.e5.
27. Gold MA, Tian C, Whitney CW, et al. Surgical versus radiographic determination of para-aortic lymph node metastases before chemoradiation for locally advanced cervical carcinoma: a Gynecologic Oncology Group Study. *Cancer*. 2008;112:1954–1963.