Original Articles

Retromesenteric para-aortic lymphadenectomy in gynecologic malignancy

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Summary

In gynecologic oncology lymphadenectomy is of prognostic and therapeutic importance because recurrence-free time and survival depend on the metastatic involvement of lymph nodes. Lymphadenectomies are not performed to such an extent as they are indicated. This might be due to a laborious or problematic preparation. The authors therefore report their experience in a seldom taught preparation of the left para-aortic compartment in the form of a learning curve. *Materials and Methods:* To access the left para-aortic area, the descending colon is lifted to open the retroperitoneum along the line of Toldt. The mesentery of the descending colon was separated from the kidney along the fascia of Gerota by blunt preparation. Time was measured from the incision of the peritoneum until the renal vein was clearly visible. *Results:* The authors collected the data from the first 25 preparations. Mean duration for the left para-aortic preparation was 7.8 minutes compared to 5.9 minutes for the right side. Duration of preparation of the left area dropped from 11.0 minutes within the first patients (#1 to #5) to 3.8 minutes in the last patients (#20 to #25). No complications were observed in the study group linked to the retromesenteric approach described. *Conclusion:* Retromesenteric para-aortic lymphadenectomy is quick to learn. The authors needed 20 preparations to observe a significant drop in the time needed for preparation. Retromesenteric para-aortic lymphadenectomy offers an excellent overview that lightens lymphadenectomy and therefore reduces the risks for patients.

Key words: Para-aortic lymphadenectomy.

Introduction

In gynecologic oncology a lymphadenectomy is of prognostic and therapeutic importance because recurrence-free time and overall survival depends on the metastatic involvement of regional lymph nodes [1]. In patients with cervical cancer (FIGO-Stage IB and IIA) five-year survival drops from more than 90% to less than 75% if metastatic disease is demonstrated in regional lymph nodes [1]. In endometrial cancer, the removal of regional lymph nodes has a significant impact on survival [2]. Pelvic sidewall failures as well as para-aortic failures in endometrial cancer are strongly correlated to the initial lymph node status [3]. In patients with ovarian cancer, up to 75% of the patients show lymph node metastases [4]. If a complete macroscopic tumor resection was achieved, survival is independently influenced by the lymph node status [5].

Yet, there is still controversy about the circumstances in which a lymphadenectomy should be conducted, and to what extent. This is even more valid for para-aortic lymphadenectomies. In patients with cervical cancer, para-aortic lymphadenectomy up to the inferior mesenteric artery seems to be adequate. In patients with high-risk endometrial cancer, 67% have para-aortic metastases caudally and cranially of the inferior mesenteric artery [6]. As in ovarian cancer, para-aortic lymphadenectomy should be extended up to the renal vessels. Yet in the USA only 54% of the centers perform lymphadenectomy in patients with endometrial cancer [2, 7]. This might be due to the workload or expertise of the surgeons.

In a classic transperitoneal approach, the preparation and the presentation of the para-aortic area can be laborious or problematic. This might lead to an insufficient presentation that can place the patient at risk due to intraoperative complications such as laceration of the large vessels. Furthermore it can be a reason for not conducting an indicated para-aortic lymphadenectomy or for an incomplete lymphadenectomy. The authors therefore asked whether there might be an easier approach to the para-aortic area.

This study describes a retromesenteric preparation of the para-aortic area. The method is known to experts in gynecologic oncology. The reason why it has not spread within the community of gynecologic surgeons who also treat the diseases remains unanswered. One answer might be the fact that there is only one publication addressing this issue. Originally the authors intended to describe the development of a new technique and evaluated it in a prospective manner. They now describe the learning curve of a simple, safe, and easy access to the retromesenteric para-aortic areas.

Materials and Methods

This prospective study was approved by the institutional review committee (07-209). Between October 2007 and July 2008 all patients that were referred to this institution for para-aortic lymphadenectomy were considered for enrollment. They

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were included after signing informed consent and if surgery was performed by one of the authors (C.A.). To take account of a possible learning curve, the authors measured the time needed for preparation of the para-aortic area in the first five patients (#1 to #5) and compared it with the last five patients (#21 to #25). Measurement commenced when the peritoneum was incised and ended when the renal vein was clearly visible and visibility had to be re-confirmed by independent members of staff.

Surgical technique

The day prior to surgery all patients received a bowel preparation. All patients were placed supine. The abdominal cavity was opened through a midline incision beginning at the pubic mound and leading around the umbilicus up to the middle between the navel and the xiphoid. In patients with cervical cancer, surgery began with para-aortic lymphadenectomy, as per the authors' guidelines. In patients with ovarian cancer, para-aortic lymphadenectomy was the last surgical step if no residual disease remained. In patients with endometrial cancer, para-aortic lymphadenectomy was begun after a frozen section confirmed the indication for lymphadenectomy.

Preparation of the left para-aortic area

The descending colon was gently lifted to expose the paracolic gutter. Then the peritoneum was incised along the paracolic gutter from the pelvic rim, where the ureter crosses the common iliac artery, up to the splenic flexure close to the descending colon. The white line of Toldt marked the entrance precisely. Once a small space was developed, the mesentery was easily mobilized by gently wiping off the surrounding tissue which was in fact the left fatty-lymphatic tissue in front of the anterior leave of the fascia of Gerota. No sharp preparation was needed, but it was worth taking time at this step of the preparation. In the majority of preparations the ovarian vessels are attached to the mesentery. The authors realized that it was easier to develop the para-aortic area if these vessels were isolated from the mesentery right at the beginning. This method of preparation automatically leads to the correct space being developed. Before this observation, the authors easily developed the space behind the kidney and could not find the renal vessels, which led to a prolonged preparation. If the renal vessels cannot be identified, it is helpful to fully mobilize the splenic flexure, which is easily done. After the presentation of the renal vein, the area of para-aortic lymphadenectomy is clearly delineated. The upper hypogastric plexus can be identified attached to the mesentery. All the fatty-lymphatic tissue between the aorta, the renal vein, and the ureter can be removed. The ovarian vessels can be easily dissected at their origin (Figures 1 and 2).

Preparation of the right para-aortic area

The preparation of the right para-aortic area was in accordance with the traditional approach. The peritoneum overlying the right common iliac artery was incised to identify the ureter and the ovarian vessels. The peritoneal incision was extended along the white line of Toldt along the right paracolic gutter up to the right colon flexure. Additionally, the peritoneum was incised towards the ligament of Treitz. The ascending colon, the coecum, the duodenum, and the small intestine can now be easily maneuvered cranially to expose the right para-aortic area. Again the segregation of the ovarian vessels from the mesenterium guides the preparation into the right plane in front of the anterior leave of the fascia of Gerota. As on the left, the area of para-aortic lymphadenectomy is clearly delineated. The upper hypogastric plexus can be identified attached to the mesentery. All the fatty-lymphatic tissue between the vena cava, the renal vein and the ureter can be removed. The ovarian vessels can be easily dissected at their origin.

Table 1. — *Patients' characteristics, para-aortic lymph node yield, and time for preparation.*

	Group A	Group C	Group B	Group R	All
Age [years] mean ± SD range	57.2 ±14.5 41 – 74	49.4 ± 18.2 27 – 69	56.4 ± 12.8 38 – 79	61.8 ± 9.9 42 – 77	57.8 ± 13.4 20 – 79
BMI [kg/m²] mean ± SD range	28.2 ± 7.5 21.0 – 40.0	21.2 ± 4.9 17 – 29	26.9 ± 5.7 19 – 40	26.8 ± 6.2 17 – 46	26.4 ± 6.7 17.0 – 46.0
lymph node yield [n] mean ± SD range	10.8 ± 2.2 8 – 11	13.4 ± 3-6 9 – 17	14.9 ± 6.5 5 – 27	9.9 ± 6.9 2 – 29	12.0 ± 6.4 2 – 29
t_{re} [min] mean ± SD range	7.4 ± 1.7 6 – 10	4.0 ± 0.7 3 – 5	6.0 ± 2.8 3 - 12	–	–
t_{lks} [min] mean ±S D range	11.0 ± 3.4 7 – 15	3.8 ± 0.8 3 – 5	8.1 ± 2.6 4 – 13	–	–
Cervical cancer	2	2	6	5	15
Uterine cancer	2	1	6	9	18
Ovarian cancer	1	2	3	7	13

Group A comprises the first patients (#1 to #5).
Group B comprises patients (#6 to #20).
Group C comprises the last five patients (#21 to #25).
Group R comprises patients who underwent open by other surgeons
Group all comprises patients all patients including five patients. Two patients underwent laparoscopic para-aortic lymphadenectomy, two patients were deemed ineligible because they were object to extensive surgery for colon cancer, primary cancer of the peritoneum and one patient with cancer of the ovary and the uterus with an enlarged uterus which reached the umbilicus.

No significant differences were observed between group (A+B+C) vs group R with regard to age and BMI. Lymph node yield was higher in group (A+B+C) compared with group R ($p = 0.049$).

Lymphadenectomy

By moving the descending colon to one side, as turning a page, one gains clear access to the contralateral side for lymphadenectomy. The inferior mesenteric artery is neither under tension nor at risk of injury, because the preparation of the left para-aortic area is not usually done from the right side underneath the inferior mesenteric artery. At the end of lymphadenectomy, homeostasis was secured by bipolar coagulation. The bowel was then repositioned. One drain is placed in the right or left para-aortic area.

Statistics

Our primary objective was the description of the technique. The secondary objective was the prospective evaluation of a learning curve by comparing the time necessary for the preparation of the para-aortic area within the first five (#1 to #5) and the last five patients (#21 to #25).

Time was measured from the incision of the peritoneal layer until clear visibility of the origin of the renal veins, and confirmed by two independent members of the stuff. Data was collected and managed within an Access database (Microsoft, Office 2007, Redmond, WA, USA). Explorative data description was calculated with Excess (Microsoft, Office 2007, Redmond, WA, USA). Comparison of the duration of the preparation was achieved by a one-sided Welch-t–test. Data was analyzed with Software R (version 2.7.0; www.r-project.org).

Figure 1. — Left para-aortic area after lymphadenectomy.

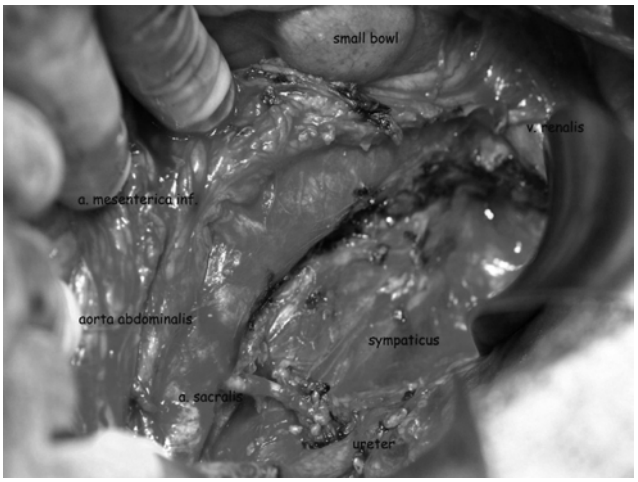


Figure 2. — Left para-aortic area after lymphadenectomy.

Results

Data from 51 consecutive patients was collected between October 2007 and July 2008. Mean age was 57.8 ± 13.4 years (range 20 – 79). Mean body mass index (BMI) was 26.4 ± 6.7 kg/m² (range 17 – 46). Para-aortic lymphadenectomy was performed in 15 patients with cervical cancer (29%), in 19 patients with uterine cancer (37%), and in 14 patients with ovarian cancer (28%), in one patient with cancer of the coecum (2%), in one patient with primary cancer of the peritoneum (2%), and in one patient with ovarian and uterine cancer (2%).

Twenty-six patients were excluded from the evaluation of the learning curve (Figure 3). Two patients underwent laparoscopic para-aortic lymphadenectomy. In one patient with ovarian and uterine cancer, the uterus reached the navel. This patient was not considered an ideal candidate for this study because keeping the uterus out of the field of preparation was laborious and did not represent the average situs. Surgical strategy had to be changed in two patients: in one patient a suspected ovarian cancer turned out to be a primary colon cancer and in one patient, the authors had to deal with a primary cancer of the peritoneum. Twenty-one patients underwent classical transperitoneal para-aortic lymphadenectomy by other members of this department (Group R).

Patients undergoing retromesenteric para-aortic lymphadenectomy were consecutively grouped. Group A comprised the first five patients (#1 to #5) Group B comprised of patients #6 to #20. Group C comprises the last five patients (#21 to #25). Characteristics of these patients did not differ among these groups and from Group R with regard to age, BMI, and indication for para-aortic lymphadenectomy (Table 1).

Mean duration for the left para-aortic preparation was 11.0 ± 3.4 min (range 7 – 15) in the first five patients and dropped significantly to 3.8 ± 0.8 min (range 3 – 5) in the last five patients (p = 0.008). Mean duration for the right para-aortic preparation was 7.4 ± 1.7 min (range 6 – 10) in the first five patients and dropped significantly to 4.0 ± 0.7 min (range 3 – 5) in the last five patients p = 0.007). (Figure 4 and Table 1).

Mean number of para-aortic lymph nodes resected was 12.0 ± 6.4 (range 2 – 29) for the overall population. Lymph node yield did not differ between group A and group C, but the lymph node yield in the study group (groups A, B, and C) was 13.8 ± 5.5 (range 5 – 27) compared to 9.9 ± 6.9 (range 2 – 29) in group R (p = 0.05) (Table 1).

One patient suffered from severe pulmonal embolism and cardiac arrest on the third day after surgery (group B, #6). Due to the severity of embolism, she underwent thrombolytic therapy after cardio-pulmonary reanimation and developed a retroperitoneal hematoma that had to be cleared twice. She left the hospital after 50 days of rehabilitation. Six months after this event, signs of cerebral hypoxia persisted (gait distribution, aphasia), but the patient was able to manage her daily life. No direct side-effects were related to the retromesenteric approach described.

Discussion

The present study demonstrates that the retromesenteric approach to the para-aortic area can easily be learned within the first 20 operations. It offers an easy and safe access to the left para-aortic area that facilitates para-aortic lymphadenectomy and resection of the renal vessels if indicated without placing structures such as the inferior mesenteric artery and the hypogastric nerves at risk.

Yet the authors' preparation is not totally unknown. Initial mobilization of the descending colon and the left colic flexure is done routinely in general surgery after resection of the sigmoid to restore intestinal continuity. Only one report describes the type of retromesenteric preparation presented in this study for para-aortic lymphadenectomy in gynecological malignancies [8]. Authors emphasize that several steps in the para-aortic lymphadenectomy become easier and complications can be readily handled - experiences that the authors fully support. Mean duration of the left para-aortic node dis-

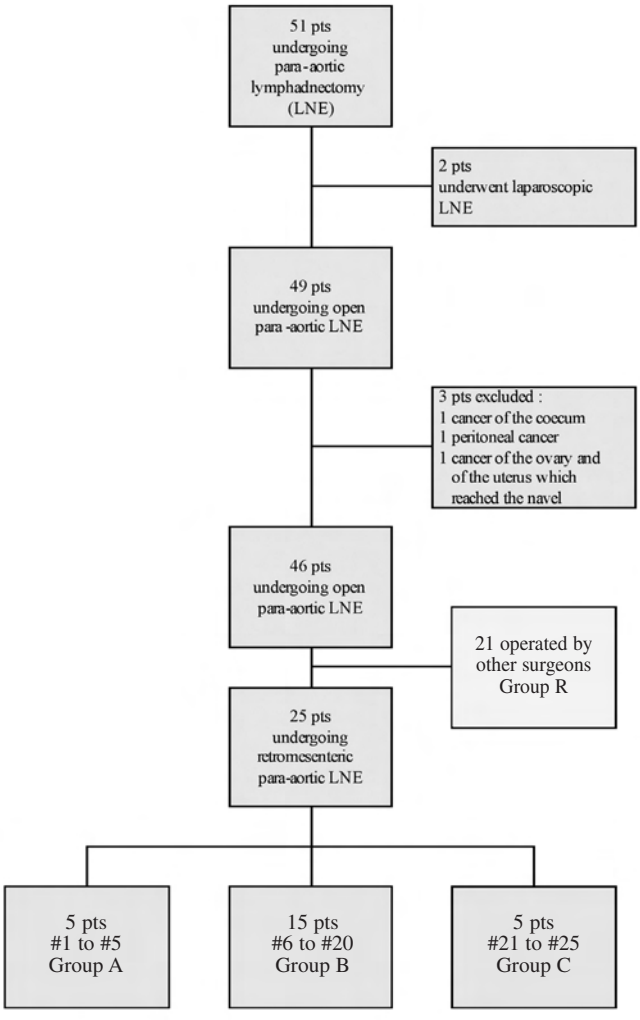
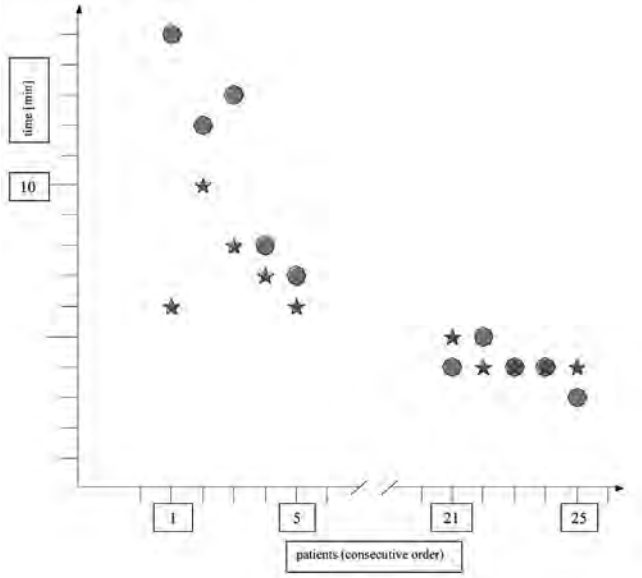


Figure 3. — Patients' flow chart.



Star = right para-aortic area; point = left para-aortic region.
Time needed for the preparation of each para-aortic area decreased significantly ($p < 0.001$).

Figure 4. — Duration for retromesenteric preparation of the para-aortic region for the first five patients compared to the last five patients.

section was 35 minutes and 70 minutes for the entire para-aortic lymphadenectomy. The median number of aortic nodes removed was 29 lymph nodes. In a later report of the same group, the initial preparation seems to be identical but the present authors would have been delighted if other authors had more clearly emphasized whether they still use their approach to the para-aortic area that is not common in the field of gynecology [9].

Traditionally, para-aortic lymphadenectomy is done transabdominally either via an open approach [1, 10] or endoscopically [11, 12]. For a right para-aortic lymphadenectomy, the coecum and the caudal part of the ascending colon are mobilized via an oblique incision heading toward the ligament of Treitz [13, 14]. The ascending colon and the small bowel are lateralized to gain sufficient access to the right para-aortic area. Usually the left para-aortic area is cleared from the right side by traversing the aorta below the inferior mesenteric artery. Laparoscopically, the left para-aortic area is also cleared underneath the inferior mesenteric artery [15]. In experienced hands, the right-sided laparoscopic para-aortic lymphadenectomy lasts 36 min and the left sided para-aortic lymphadenectomy lasts 64 min [16]. The difference between the two sides might be due to the differing anatomies. Although the traditional approach to the left para-aortic area is safe, the preparation and presentation appear to be strenuous because traction and retractors are necessary to gain enough access without compromising the supply in the inferior mesenteric artery. To avoid post-operative adhesion formation, some groups perform a retroperitoneal approach that can be achieved via an open access [17] or endoscopically [18-21]. Again anatomy might be the reason for a limited para-aortic lymphadenectomy, especially for the contralateral side.

To assess an amelioration of technical skills, one has to define hallmarks to measure any effect. This can be the number of complications [16], the number of resected lymph nodes [22], the duration of the procedure [23], or an increasing radicality [24, 25].

When the authors designed this small series, they were confident that it would not take too many patients to make a difference. They also had the experience that the lymph node count depends on several aspects, including the pathologist's motivation [23]. Additionally, the whole surgical procedure of a complete para-aortic lymphadenectomy depends on several co-factors. Therefore the authors decided to focus on the main step which was the preparation of the area of interest. From their point of view, the difference in the duration of the preparation of the two para-aortic areas will be due to the position of the

sigmoid with its blood supply and the easier mobilization of the ascending colon and the mesentery of the small bowel. The fact that the preparation of the right para-aortic side consists of known steps is the reason why the initial time for preparation was quicker, yet the authors could observe a significant improvement in the time needed for presenting the target area; the preparation of the left side, on the other hand, was completely new to them. Fortunately they observed no direct complication associated with this retromesenteric approach. Yet this series was large enough to draw attention to the increased wound surface that could lead to secondary hemorrhage. Larger populations would be necessary to detect possible differences like complication rate compared with the traditional transperitoneal approach.

The present findings and conclusions would no doubt be corroborated and enhanced by observing several different surgeons consecutively, but it is debatable whether a repeat of the same learning pattern in each surgeon would be witnessed, or (more likely) the handing over from one surgeon to the next of the experience gained in these first patients.

Though the present authors are not the first team to describe this technique, they can show that it is quick to learn. The essential steps are in entering the retromesenteric area along the line of Toldt to isolate the ovarian vessels from the posterior aspect of the mesenterium, so that the retromesenteric space can be opened by blunt preparation by letting the kidney fall into its bed. The authors suggest naming this procedure a "retromesenteric" access to the left para-aortic area. The presentation of the left para-aortic area is easy and enables the surgical team to perform a suitable lymphadenectomy without causing strain or risk for the patient. Left and right para-aortic basins can be easily surveyed by maneuvering the mesenterium - like turning over a page.

The authors hope readers are motivated to try this approach, so that they will become convinced of the ease of this preparation, just as they were overwhelmed when they started it.

References

[1] Berek J., Hacker N.: "Practical Gynecologic Oncology". Philadelphia: Lippincott Williams & Wilkins, 2005.

[2] Abu-Rustum N., Iasonos A., Zhou Q., Oke E., Soslow R.A., Alektiar K.M. *et al*.: "Is there a therapeutic impact to regional lymphadenectomy in the surgical treatment of endometrial cancer?". *Am. J. Obstet. Gynecol.,* 2008, *198,* 457.e1.

[3] Mariani A., Webb M., Keeny G., Aletti G., Podratz K.: "Predictors of lymphatic failure in endometrial cancer". *Gynecol. Oncol.,* 2002, *84,* 437.

[4] di Re F., Baiocchi G., Fontanelli R., Grosso G., Cobellis L., Raspagliesi F., di Re E.: "Systematic pelvic and paraaortic lymphadenectomy for advanced ovarian cancer: prognostic significance of node metastases". *Gynecol. Oncol.,* 1996, *62*, 360.

[5] Wang Z., Xiong Z., Wang S.J.: "Effect of retroperitoneal lymphadenectomy on prognosis of patients with epithelial ovarian cancer". *Chin. Med. J*., 2003, *116,* 588.

[6] Mariani A., Dowdy S.C., Cliby W.A., Gostout B.S., Jones M.B., Wilson T.O., Podratz K.C.: "Prosepective assessment of lymphatic dissemination in endometrial cancer: A paradigm shift in surgical staging". *Gynecol. Oncol*., 2008, *109*, 11.

[7] Maggino T., Romagnolo C., Landoni F., Sartori E., Zola P., Gadducci A.: "An analysis of approaches to the management of endometrial cancer in North America: a CTF Study". *Gynecol. Oncol*., 1998, *68,* 274.

[8] Benedetti-Panici P., Maneschi F., Scambia G., Manusco S.: "A new transabdominal approach to the left retroperitoneum for systematic removal of lymph-nodes left of the aorta in gynecologic malignancies". *Obstet. Gynecol*., 1994, *83,* 1060.

[9] Benedetti-Panici P., Calcagno M., Plotti F., Arrivi C., Di Donato V., Montera R., Angioli R.: "Aortic lymphadenectomy in cervical cancer: Anatomy, classification and technique". *Gynecol. Oncol*., 2007, *107* (1 suppl. 1), S30.

[10] Hirsch H., Käser O., Iklé F.: "Lymphonodektomie". In: Hirsch H., Käser O., Iklé F. (eds.). Atlas der gynäkologischen Operationen. Stuttgart, New York: Georg Thieme Verlag, 1995, 356.

[11] Herd J., Fowler J., Shenson D., Lacy S., Montz F.: "Laparoscopic para-aortic lymph node sampling: development of a technique". *Gynecol. Oncol.,* 1992, *44,* 271.

[12] Childers J., Surwitt E.: "Combined laparoscopic and vaginal surgery for the management of two cases of Stage I endometrial cancer". *Gynecol. Oncol*., 1992, *45,* 46.

[13] Fowler J., Johnson P.: "Transperitoneal para-aortic lymphadenectomy". *Operat. Techn. Gynecol. Surg*., 1996, *1,* 8.

[14] Lubicz S.: "Approach to the abdominal retroperitoneum in patients with gynecologic malignancies". *Gynecol. Oncol.,* 1985, *22*, 32.

[15] Childers J., Hatch K.D., Tran A.-N., Surwit E.: "Laparoscopic para-aortic lymphadenectomy in gynecologic malignancies". *Obstet. Gynecol*., 1993, *82*, 741.

[16] Köhler C., Klemm P., Schau A., Possover M., Krause N., Tozzi R., Schneider A.: "Introduction of transperitoneal lymphadenectomy in a gynecologic oncology center: analysis of 650 laparoscopic pelvic and/or paraaortic transperitoneal lymphadenectomies". *Gynecol. Oncol*., 2004, *95,* 52.

[17] Vasilev S.: "A modified incision and technique for total retroperitoneal access and lymph node dissection". *Gynecol. Oncol.,* 1995, *56*, 226.

[18] Querleu D., Dargent D., Ansquer Y., Leblanc E., Narducci F.: "Extraperitoneal endosurgical aortic and common iliac dissection in the staging of bulky or advanced cervical carcinomas". *Cancer,* 2000, *88*, 1883.

[19] Burnett A., O'Meara A., Bahador A., Roman L., Morrow P.: "Extraperitoneal laparoscopic lymph node staging: the University of Southern California experience". *Gynecol. Oncol.,* 2004, *95,* 189.

[20] Vasilev S., McGonigle K.: "Extraperitoneal laparoscopic paraaortic lymph node dissection". *Gynecol. Oncol*., 1996, *61*, 315.

[21] Dubuisson J., De Dycker Y., Yaron M.: "The retroperitoneal approach in minimally pelvic surgery". *Ann. N.Y. Acad. Sci*., 2006, *1092*, 187.

[22] Raatz D., Börner P.: "Die laparoskopisch assistierte vaginale Radikaloperation LAVRO des Zervixkarzinoms - Perioperative Parameter und Komplikationsraten". *Zentralblatt für Gynäkologie,* 2001, *123*, 136.

[23] Altgassen C., Possover M., Krause N., Plaul K., Michels W., Schneider A.: "Establishing a new technique of laparoscopic pelvic and para-aortic lymphadenactomy". *Obstet. Gynecol*., 2000, *95,* 348.

[24] Schneider A., Possover M., Kamprath S., Endisch U., Krause N., Nöschel H.: "Laparoscopy-assisted radical hysterectomy modified according to Schauta-Stoeckel". *Obstet. Gynecol*., 1996, *88,* 1057.

[25] Spirtos N., Schlaerth J., Spirtos T., Schlaerth A., Indman P., Kimball R.: "Laparoscopic bilateral pelvic and paraaortic lymph nodesampling: An evolving technique". *Am. J. Obstet. Gynecol*., 1995, *173,* 105.

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