

Laparoscopic Radical Hysterectomy and Lymph Node Dissection Learning Experience at Campus Virchow – Charité

MUSTAFA ZELAL MUALLEM¹, AARNE FELDHEISER² and JALID SEHOULI¹

¹*Departments of Gynecology and Obstetrics, Charité/Campus Virchow-Klinikum, University Medicine of Berlin, Berlin, Germany;*

²*Department of Anesthesiology, Charité/Campus Virchow-Klinikum, University Medicine of Berlin, Berlin, Germany*

Abstract. Aim: The purpose of this study was to establish and analyze the laparoscopic technique of radical hysterectomy and para-aortic and pelvic lymphadenectomy and to retrospectively evaluate its feasibility and morbidity. Patients and Methods: During a one-year period 12 patients underwent laparoscopic radical surgical procedures for cervical or endometrial cancer. All our patients underwent radical pelvic lymphadenectomy, whereas we performed radical para-aortic lymphadenectomy alone in five patients and radical type-C hysterectomy in eight patients. Results: The mean operating time for para-aortic and pelvic lymphadenectomy was 120 and 152 minutes respectively, and 153.75 minutes for type C hysterectomy. A mean of 41.6 pelvic lymph nodes and 21.2 para-aortic lymph nodes were removed. The mean extensions of parametrium in laparoscopic radical hysterectomy type C were 45×30 mm. Conclusion: Following a short learning curve, laparoscopic para-aortic and pelvic lymphadenectomy is a safe and effective technique for staging cervical, and endometrial cancer

Total laparoscopic radical hysterectomy was described initially by Canis *et al.* (1) and Nezhat *et al.* (2). Since then, many other studies have shown the feasibility, safety and efficacy of this procedure (3-6). All comparisons between open and laparoscopic-based radical operations for the treatment of women with early cervical cancer favour laparoscopy with respect to blood loss, hospital stay,

recovery, and cosmetic result (7-9), and show identical oncological outcomes and no adverse effects on overall prognosis and survival (3-9). In general, minimal invasive surgery has advantages over abdominal surgery, including shorter hospitalization, less blood loss, faster return of bowel function, faster overall recovery time, fewer complications and better cosmetic results. Nevertheless, this technique has its limitations, such as a long learning curve, two-dimensional views with reduced depth perception, rigid instruments and poor ergonomics resulting in surgeon fatigue, tremor and awkward positioning. Furthermore, patients with gynecological malignancies may benefit from a minimally-invasive approach as, due to fewer complications and a faster recovery, additional adjuvant (chemo)radiation may be initiated more quickly (10).

The purpose of this study was to establish and analyze a laparoscopic technique of radical hysterectomy and para-aortic and pelvic lymphadenectomy and to retrospectively evaluate the feasibility and morbidity of total laparoscopic radical hysterectomy and lymphadenectomy performed at Virchow campus – Charite, Berlin, Germany.

Patients and Methods

This work is a preliminary report of patients with cervical and endometrial cancer, who underwent minimally-invasive surgery as the primary treatment at the Virchow campus – Charite, Berlin, Germany between July 2011 and July 2012. Institutional Review Board approval was obtained under a registration number EA2/041/13. In this period, we introduced for the first time laparoscopic radical hysterectomy (LRHE) type C according to the Querleu/Morrow Classification (11) and laparoscopic radical lymph node dissection (LRLND) as a first choice for patients with cervical cancer (stage I-II according to the classification of International Federation of Gynaecology and Obstetrics - FIGO) and endometrial cancer FIGO Ia with risk factors such as G3, or type II histology, or FIGO Ib-III.

All the patients who underwent laparoscopic radical surgery were informed that laparotomy would be carried out if difficulties were encountered with the laparoscopic approach, and all women gave

Correspondence to: Dr. med. Dr. med (syr). Mustafa Zelal Muallem, Charité Universitätsmedizin Berlin, Campus Virchow-Klinikum, Augustenburger Platz 1, 13353 Berlin, Germany. Tel: +49 30450664373, Fax: +49 30450564900, e-mail: Mustafa-Zelal.Muallem@charite.de

Key Words: Laparoscopic radical hysterectomy, laparoscopic lymph node dissection, learning curve, initial experience, total mesometrial resection.

their informed consent. The same surgeon performed all the laparoscopic interventions. Data were obtained from medical, anaesthesiological and pathological records.

This retrospective study included eight patients, who underwent LRHE for endometrial cancer with infiltration of the parametrium in one patient, and for cervical cancer FIGO Ib1/Ib2 in seven patients, with pelvic LRLND for the patients with cervical cancer (all seven patients had negative lymph nodes at frozen section evaluation for samples obtained from common iliac and inframesenteric aortic areas), and with pelvic and para-aortic LRLND, omentectomy and peritoneal biopsies for the patients with endometrial cancer. The pathological diagnosis of cervical carcinoma was confirmed before the operation either by cervical punch biopsy or after a cone biopsy in six patients.

Another four patients in this study underwent pelvic and para-aortic LRLND in one case with cervical carcinoma FIGO IIIb as a staging intervention before the planned radiochemotherapy; total laparoscopic hysterectomy (type A) and bilateral salpingo-oophorectomy and peritoneal biopsies in one case with endometrial carcinoma FIGO Ia, type I, G3; total laparoscopic hysterectomy (type A) and bilateral salpingo-oophorectomy, omentectomy and peritoneal biopsies in one patient with endometrial carcinoma FIGO Ib, type II, G3; and with a total laparoscopic hysterectomy (type B) and bilateral salpingo-oophorectomy, omentectomy and peritoneal biopsies in one case with endometrial carcinoma FIGO IIIb, type I, G3.

Inclusion criteria for both groups were body-mass index (BMI)≤35 and no evidence of potential extrapelvic disease (FIGO I-II for cervical cancer, and FIGO I-III for endometrial cancer). All patients received one-shot antibiotic prophylaxis (cefuroxime 1.5 g intravenously plus metronidazole 500 mg intravenously preoperatively) and perioperative low molecular weight Fraxiparin (0.4 ml/24 h) subcutaneously 12 h before the operation. Blood loss was estimated by subtracting the volume of the irrigation fluid from the total amount of fluid in the suction apparatus. Endpoints of this study were status of the surgical margins, status of lymph nodes removed, short-term postoperative complications (within 30 days of the procedure), long-term postoperative complications (more than 30 days after the procedure), postoperative therapy, length of hospitalization, median follow-up duration, recurrence, and disease-free interval.

Results

We divided our patients into two groups, eight patients who underwent LRHE with pelvic/para-aortic lymph node dissection, and four patients who underwent laparoscopic radical pelvic and para-aortic lymph node dissection within the context of staging surgery for endometrial or cervical cancer.

The mean age was 49.6 years (34-69). The entire group included four patients with endometrial carcinoma (three endometrioid, and one serous papillary), and eight patients with cervical cancer (six squamous epithelial, and two adenocarcinomas with a neuro-endocrinol component in one patient).

LRHE (type C) was performed for six patients with cervical cancer FIGO Ib1 (clinical staging), one patient with cervical cancer FIGO Ib2, and one patient with endometrial cancer FIGO II (clinical staging before the operation, which was upstaged later to IIIc2). We

performed laparoscopic nerve-sparing Okabayashi radical hysterectomies modified by Fuji (12) in the first three patients, then we performed total mesometrial resections (TMMR) (13) in the remaining five patients.

Out of patients who underwent staging operations with laparoscopic radical pelvic and para-aortic lymph node dissection, one had inoperable cervical cancer FIGO IIb, and three patients with endometrial cancer (FIGO Ia, type I, G3; FIGO Ib, type II, G3; and FIGO IIIb, type I, G3), the first two patients underwent total laparoscopic hysterectomy type A and the last patient underwent total laparoscopic hysterectomy

During the observation period, the mean operating time for para-aortic and pelvic lymphadenectomy was 152 and 120 minutes respectively. The mean time for laparoscopic hysterectomy was 153.75 minutes for type C, 120 minutes for type B and 90 minutes for type A. The mean time for laparoscopic nerve-sparing Okabayashi radical hysterectomy (the first three LRHE patients) was 166 minutes, whereas TMMR was performed in the next five LRHE patients in 146 minutes.

The mean total operating time (LRHE with pelvic node dissection) was 303 minutes (318.3 minutes for nerve-sparing Okabayashi radical hysterectomy and 294 minutes for TMMR). Various patient and operative characteristics are shown in Table I.

Operative results. A mean of 41.6 pelvic lymph nodes (12 patients) and 21.2 para-aortic lymph nodes (five patients) were retrieved. The para-aortic lymph node dissection was performed up to the level of left renal vein. The mean extension of parametrium in LRHE type C was 44.3×28.6 mm, and 46.4×31 mm for the right and left sides respectively. The mean size of cervical tumour was 32.4 mm (3-60 mm). Two patients with cervical cancer had positive pelvic lymph nodes and one with endometrial cancer had positive pelvic and para-aortic lymph nodes discovered at final histological examination.

Positive resection margins were diagnosed in one patient with endometrial carcinoma, who underwent a staging laparoscopic operation with total hysterectomy type B. The pathological study showed R1 resection of the right parametrium. Ovaropexy was indicated and performed in five patients with cervical cancer.

The mean estimated intraoperative blood loss was 123.75 ml (20-300 ml), which differentiated dramatically between laparoscopic nerve-sparing Okabayashi radical hysterectomy operations and TMMR, 223.3 vs. 64 ml respectively. Haemoglobin decline, which was not combined directly with blood loss, was a mean of 2.9 g/dl (0.5-5.2 g/dl).

In this series of patients, only one patient required conversion to mini-laparotomy, because of bleeding. One intraoperative incidental cystotomy occurred in the LRHE group at the time of laparoscopic bladder dissection of the anterior vagina. This complication was recognized

Table I. Characteristics of 12 patients with cervical or endometrial cancer surgically treated with laparoscopic radical lymph node dissection with/without LRHE.

	Group 1 (n=8)	Group 2 (n=4)
Age (mean=49.6)	46.25 (34-54)	55.25 (44-69)
Cervical cancer		
Squamous epithelial	5	1
Adenocarcinoma	2	-
Endometrial cancer		
Type I	1	2
Type II	-	1
Cervical cancer stage		
Ib1	6	-
Ib2	1	-
≥IIB	-	1
Endometrial cancer stage		
Ia	-	1
Ib	-	1
≥II	1	1
Grading		
G2	3	-
G3	5	4
Type of hysterectomy		
A	-	2
B	-	1
C	8	-
Operative time, minutes	303 (260-350)	280 (250-310)
LRHE with pelvic node dissection	Only for pelvic and para-aortic lymph node dissection	

intraoperatively and repaired laparoscopically. Unfortunately, it later induced a vesicovaginal fistula. These patients then underwent a second vaginal operation to close this fistula according Latzko's technique. We also found one case of moderate subcutaneous emphysema, one case of urinary tract infection, one vaginal dehiscence and one case of postoperative fever.

There were no vascular, intestinal, or ureteral injuries in this study. Most complications were associated with radical hysterectomy and not with radical lymphadenectomy. Most of our patients stayed for more than a week in the hospital (5-20 days). This long hospital stay was related more to our local discharge protocol than to the medical needs.

In the first group of patient, radiochemotherapy was administered to six patients, chemotherapy with six cycles of carboplatin 5(AUC) plus paclitaxel at 175 mg/m² in one patient (endometrial cancer), and a follow-up alone in one patient. In the second group, two patients received radiochemotherapy, one patient received six cycles of carboplatin 5 (AUC) plus paclitaxel at 175 mg/m², and in one patient only follow-up was performed. The short follow-

Table II. Pathological and clinical outcomes of radical gynaecological laparoscopic intervention in our study.

Parameters	Mean	Range
Number of retrieved pelvic lymph nodes (n=12)	41.6	27-53
Right common iliac	4.4	1-9
Left common iliac	5.3	2-10
Right external iliac	5.6	2-13
Right internal iliac	2.7	0-7
Right <i>fossa obturatoria</i>	8.5	2-13
Left external iliac	5.2	2-8
Left internal iliac	1.9	0-6
Left <i>fossa obturatoria</i>	7.5	2-16
Number of retrieved para-aortic lymph nodes (n=5)	21.2	15-39
Para caval	3.6	2-6
Interaortocaval	7.4	3-17
Para-aortal	10.2	5-16
Parametrial extension, mm (n=8)		
Right	44.3×28.6	
Left	46.4×31	
Cervical tumour size, mm (n=8)	32.4	3-60
Number of positive lymph nodes (n=3)		
Pelvic	3	1-5
Para-aortic	4	-
Blood loss, ml (n=12)	123.75	20-300
Haemoglobin decline, g/dl (n=12)	2.9	0.5-5.2
Adjuvant therapy (n=12)	10 (83.3%)	

up for a maximum of one year showed no recurrence. All pathological and clinical outcomes are presented in Table II.

Anaesthesiological results. To address possible influences other than of surgical and pathological origin on the laparoscopic radical oncological surgeries, we analysed the anaesthesiological parameters of our patients.

The review of the anaesthesiological outcome of this series of patients was possible only in eleven cases (unfortunately, the documentation of one patient was lost).

In this series, 7/11 patients received a central venous line, 9/11 of cases received an arterial line and an epidural catheter for pain management was inserted in two out of eleven cases. A forced-air patient warming system was connected to all patients to preserve normal body temperature. Throughout surgery, general anaesthesia was maintained with total intravenous anaesthesia using propofol in two out of eleven cases or inhalative anaesthesia with sevoflurane in 6/11 and desflurane in 3/11 of cases. The depth of anaesthesia was monitored in all patients receiving propofol using the bispectral index (BIS). The mean dose of fentanyl was 0.32 mg (range=0-0.50 mg) and the highest rate of remifentanil was 0.25 µg/kg/min (0.10-0.40 µg/kg/min). Prophylaxis of postoperative nausea and vomiting (PONV) was initiated in 8/11 of cases.

Table III. Anaesthesiological management of radical gynaecological laparoscopic intervention

Parameter	Study population n=11
Arterial line, n	9
Central venous line, n	7
Epidural catheter placement, n	2
Active warming system used, n	11
Prophylaxis of postoperative, n	8
Bispectral index used, n	2
Maintenance of anaesthesia:	
Propofol, %	2
Sevoflurane, %	6
Desflurane, %	3
Balanced crystalloid solution, ml	2850 (1800-5000)
Balanced colloid solution, ml	1000 (0-1500)
Highest noradrenaline rate, µg/kg/min	0.12 (0-0.17)
Highest arterial CO ₂ tension (paCO ₂), mmHg	50.9 (40.9-74.5)
Highest end-tidal CO ₂ tension, mmHg	45.6 (40.0-61.0)
Cumulative administered fentanyl, mg	0.32 (0-0.50)
Highest remifentanil rate, µg/kg BW/min	0.25 (0.10-0.40)
Postoperative analgesia:	
Piritramide, mg	7.7 (0-15.0)
Metamizole, g	1.44 (0-2.0)
Postoperative observation:	
Recovery room, n	6
ICU, patient extubated, n	1
ICU, patient intubated, n	4

Intravenous tranexamic acid or any other coagulation factors were not administered and no blood transfusions were necessary. The mean amount of balanced crystalloid solutions used intraoperatively was 2850 ml (1800-5000 ml) and of balanced colloid solution was 1000 ml (0-1500 ml). The highest noradrenaline rate was 0.12 µg/kg BW/min (0-0.17 µg/kg BW/min). The highest arterial carbon dioxide tension was 50.9 mmHg (40.9-74.5 mmHg), whereas the highest end-tidal carbon dioxide tension was 45.6 mmHg (40-61 mmHg).

Postoperative pain management was achieved using piritramide and metamizole at mean administered amounts of 7.7 mg (0-15 mg) and 1.44 g (0-2 g), respectively. For early postoperative observation 6/11 of patients were transferred to the recovery room whereas 5/11 patients were transferred to an intensive care unit, one of them was successfully extubated immediately after surgery and 4/11 of patients stayed intubated due to low body temperature (Table III).

Discussion

In this study, we reported on our initial experience of LRHE and LRLND at the Department of Gynecology at the Virchow campus, Charite – Berlin. During the past decade, some reports have already shown the feasibility of LRHE in patients with cervical cancer, but despite the advantages of

conventional laparoscopy over laparotomy (shorter hospitalization, faster bowel function recovery, less postoperative pain, decreased overall cost), it is not without drawbacks (2, 14).

Yan *et al.* (15), described 117 consecutive patients of cervical cancer with stages Ib (n=96) and IIa (n=21), who were operated from August 1998 to December 2006. The overall conversion rate was 1.7% (2/117). Four patients had vessel injuries, 3 of which were treated laparoscopically. Cystotomy occurred in five patients. One case of stage IIa with a bladder laceration longer than 3 cm was converted to laparotomy. The remaining four were managed laparoscopically. Postoperative complications occurred in 38.5% (n=45) of the patients, including 38 patients with urinary retention who exhibited complete resolution within six months, four with lymphocyst who underwent conservative treatment, one with ureteral fistula, one with mild adynamic bowel obstruction who received conservative management, and one with vesicovaginal fistula that was closed by conservative treatment.

A large study by Puntamabekar *et al.* (16) showed a significantly shorter operative time and a high number of positive lymph nodes. The mean operative time was 92 minutes (range=65-120 minutes), and the mean number of resected pelvic nodes was 18. The mean blood loss was 165 ml. All 15 intraoperative complications were tackled laparoscopically. No patients were converted to the open technique. Seventeen patients had complications within two months of surgery. Seven patients had recurrences after a mean follow-up of 36 months.

Spirtos *et al.* (17) describes 78 consecutive patients, all with early cervical cancer. In that series, 94% of the procedures were completed laparoscopically. The average operative time was 205 min, and the average blood loss was 225 ml. One patient (1.3%) required a blood transfusion, three patients had unintended cystotomies, two patients required laparotomy to control bleeding, and one patient suffered a ureterovaginal fistula. Three patients had microscopically positive or close margins. The authors reported a recurrence rate of 5%. A study by Pellegrino *et al.* (18) reviewed 107 patients underwent LRHE and pelvic LRLNE between September 2001 and October 2007. Conversion to laparotomy was necessary in six patients. The mean number of resected pelvic lymph nodes was 26. The mean blood loss was 200 ml and the mean duration of surgery was 305 min. Minor intraoperative complications were registered in two patients, while five patients needed a second surgery for postoperative complications. Thirteen patients had microscopic nodal metastasis. A total of 24 patients received adjuvant therapy. After a mean follow-up of 30 months, 11 patients had a disease recurrence.

Abu-Rustum *et al.* (19) published a retrospective review of 19 patients with stage IA1-IB1 cervical cancer. In their series, two patients required conversion to laparotomy to

control parametrial bleeding (one patient) and repair a cystotomy (one patient). The surgeons in that study also used ureteral catheters in 37% of patients. Intraoperative complications included cystotomy (five patients), iliac vein injury (five patients), and ureteral transection (one patient).

In a review on total laparoscopic and robot-assisted radical hysterectomy with pelvic lymphadenectomy in the treatment of early-stage cervical cancer, Kruijdenberg *et al.* (10) identified 27 studies that met the inclusion criteria, together with their own unpublished data of patients, accounting for 342 robot-assisted radical hysterectomy patients and 914 LRHE patients. The mean operating time from all included LRHE studies was 202 (184-221) minutes, the mean blood loss 156 (109-223) ml, the mean number of retrieved lymph nodes was 21 (18-23). The conversion rate was 1.6%. Intraoperative and postoperative complication rates were 6%, and 21.4% respectively.

We could not find any study which reported about the dimensions of laparoscopically restricted parametrium to compare it with our results.

In review of our initial experience with LRHE and LRLND in comparison with published studies, we conclude that we were able to achieve a radical laparoscopic resection with more lymph nodes retrieved in pelvic and para-aortic area than all reported laparoscopic outcomes. Our mean operative time is comparable to the mean time of most studies. Blood loss and complication rate were also in the range of other studies.

In conclusion, we have shown that total LRHE is a safe and feasible procedure. After a short learning curve laparoscopic para-aortic and pelvic lymphadenectomy is a safe and effective technique for staging cervical and endometrial cancer. A learning curve for LRHE should be longer. We estimate that 10-15 operations are adequate for a well qualified surgeon to be able to perform this operation safely and effectively.

References

- 1 Canis M, Mage G, Wattiez A, Pouly JL, Manhes H and Bruhat MA: Does endoscopic surgery have a role in radical surgery of cancer of the *cervix uteri*? *J Gynecol Obstet Biol Reprod* **19**: 921-925, 1990.
- 2 Nezhat CR, Burrell MO, Nezhat FR, Benigno BB and Welander CE: Laparoscopic radical hysterectomy with para-aortic and pelvic node dissection. *Am J Obstet Gynecol* **166**: 864-865, 1992.
- 3 Pomel C, Canis M, Mage G, Dauplat J, Le Bouedec G and Raiga J: Laparoscopically extended hysterectomy for cervix cancer: technique, indications and results. A propos of a series of 41 cases in Clermont. *Chirurgie* **122**: 133-136, 1997.
- 4 Krause N and Schneider A: Laparoscopic radical hysterectomy with paraaortic and pelvic lymphadenectomy. *Zentralbl Gynakol* **117**: 346-348, 1995. (Article in German).
- 5 Kim DH and Moon JS: Laparoscopic radical hysterectomy with pelvic lymphadenectomy for early, invasive cervical carcinoma. *J Am Assoc Gynecol Laparosc* **5**: 411-417, 1998.
- 6 Spiro NM, Schlaerth JB, Kimball RE, Leiphart VM and Ballon SC: Laparoscopic radical hysterectomy (type III) with aortic and pelvic lymphadenectomy. *Am J Obstet Gynecol* **174**: 1763-1767, 1996.
- 7 Park CT, Lim KT, Chung HW, Lee KH, Seong SJ and Shim JU: Clinical evaluation of laparoscopic-assisted radical vaginal hysterectomy with pelvic and/or paraaortic lymphadenectomy. *J Am Assoc Gynecol Laparosc* **9**: 49-53, 2002.
- 8 Frumovitz M, dos Reis R, Sun CC, Milam MR, Bevers MW and Brown J: Comparison of total laparoscopic and abdominal radical hysterectomy for patients with early-stage cervical cancer. *Obstet Gynecol* **110**: 96-102, 2007.
- 9 Ghezzi F, Cromi A, Ciravolo G, Volpi E, Uccella S and Rampinelli F: Surgicopathologic outcome of laparoscopic versus open radical hysterectomy. *Gynecol Oncol* **106**: 502-506, 2007.
- 10 Kruijdenberg CB, van den Einden LC, Hendriks JC, Zusterzeel PL and Bekkers RL: Robot-assisted versus total laparoscopic radical hysterectomy in early cervical cancer, a review. *Gynecol Oncol* **120**: 334-339, 2011.
- 11 Querleu D and Morrow CP: Classification of radical hysterectomy. *Lancet Oncol* **9**: 297-303, 2008.
- 12 Fujii S, Takakura K, Matsumura N, Higuchi T, Yura S and Mandai M: Anatomic identification and functional outcomes of the nerve sparing Okabayashi radical hysterectomy. *Gynecol Oncol* **107**: 4-13, 2007.
- 13 Höckel L.-C, Horn B, Hentschel S, Höckel G and Naumann: Total mesometrial resection: High resolution nerve-sparing radical hysterectomy based on developmentally defined surgical anatomy. *Int J Gynecol Cancer* **13**: 791-803, 2003.
- 14 Dakin GF and Gagner M: Comparison of laparoscopic skills performance between standard instruments and two surgical robotic systems. *Surg Endosc* **17**: 574-579, 2003.
- 15 Yan X, Li G, Shang H, Wang G, Chen L and Han Y: Complications of laparoscopic radical hysterectomy and pelvic lymphadenectomy—experience of 117 patients. *Int J Gynecol Cancer* **Jul 19**: 963-967, 2009.
- 16 Puntambekar SP, Palep RJ, Puntambekar SS, Wagh GN, Patil AM and Rayate NV: Laparoscopic total radical hysterectomy by the Pune technique: Our experience of 248 cases. *J Minim Invasive Gynecol* **14**: 682-689, 2007.
- 17 Spiro NM, Eisenkop SM, Schlaerth JB and Ballon SC: Laparoscopic radical hysterectomy (type III) with aortic and pelvic lymphadenectomy in patients with stage I cervical cancer: Surgical morbidity and intermediate follow-up. *Am J Obstet Gynecol* **187**: 340-348, 2002.
- 18 Pellegrino A, Villa A, Frusci R, Signorelli M, Meroni MG, Iedà N and Vitobello D: Total laparoscopic radical hysterectomy and pelvic lymphadenectomy in early-stage cervical cancer. *Surg Laparosc Endosc Percutan Tech* **18**: 474-478, 2008.
- 19 Abu-Rustum NR, Gemignani ML, Moore K, Sonoda Y, Venkatraman E and Brown C: Total laparoscopic radical hysterectomy with pelvic lymphadenectomy using the argon-beam coagulator: Pilot data and comparison to laparotomy. *Gynecol Oncol* **91**: 402-409, 2003.

Received May 9, 2013

Revised May 24, 2013

Accepted May 28, 2013