Evaluation of total laparoscopic hysterectomy with lymphadenectomy in surgical treatment of endometrial cancers

Ocena całkowitej laparoskopowej histerektomii z limfadenektomią w operacyjnym leczeniu raka endometrium

Andrzej Malinowski, Dominika Majchrzak-Baczmańska, Krzysztof Pogoda, Grażyna Maciołek-Blewniewska, Beata Antosiak

Department of Surgical and Endoscopic Gynecology, Polish Mother's Memorial Hospital – Research Institute, Lodz, Poland

Abstract

Objectives: *The study was conducted to evaluate the efficacy, feasibility and safety of total laparoscopic hysterectomy (TLH) with lymphadenectomy in the treatment of endometrial cancer.*

Material and methods: *The retrospective study included 31 patients with endometrial cancer who underwent TLH with lymphadenectomy and 42 patients with endometrial cancer who were operated by laparotomy. In both groups the following parameters were analyzed: age, BMI, accompanying diseases, previous surgeries, parity, duration of the surgery, blood loss (complete blood count before and after the operation was compared), necessity of blood transfusion, length of hospital stay, uterine volume, grade, stage of endometrial cancer (FIGO), and intra/postoperative complications.*

Results: *Mean age of patients was lower in the laparoscopic group than in women operated by laparotomy: 54 and 64, respectively (p=0.0001). There were no significant differences between both groups in BMI, uterine volume, grade, staging (FIGO), and parity. The percentage of patients with accompanying chronic diseases in the TLH group was lower than in the laparotomy group: 48.39% and 83.34%, respectively (p=0,032). There were no significant differences between both group in the history of previous laparotomies (p=0.704). Mean duration of surgery was shorter in the case of laparotomy than in case of laparoscopy: 130.6 and 151.77, respectively (p=0.003). Laparotomy was associated with greater blood loss during surgery. Statistically significantly higher decrease in the Hb concentration and Hct values was noted in the group operated by laparotomy when compared to laparoscopy (mean values: Hb-1.17g/dl, Hct-3.49% for the TLH technique and Hb-1.8g/dl Hct-5.47% for laparotomy; p=0.011-Hb; p=0.003-Hct). Mean hospital stay after laparoscopy was shorter than after laparotomy – 4 and 9 days, respectively (p=0,0001).*

Corresponding author:
Dominika Majchrzak-Baczmańska,
Department of Surgical and Endoscopic Gynecology, Polish Mother's Memorial Hospital – Research Institute (Lodz, Poland)
ul.Rzgowska 281/289, 93-338 Lodz, Poland,
tel: (+48) 422711475; fax: (+48) 42271147 ; e-mail: majchrzak.dominika@gmail.com ,

Malinowski A, et al. *Evaluation of total laparoscopic hysterectomy with lymphadenectomy in surgical treatment of endometrial cancers.*

The influence of the operational technique on the number of pelvic lymph nodes taken for histopathological examination was evaluated. No statistically significant correlation between the number of lymph nodes taken for histopathological examination during the surgery and the operational technique was noted (p=0.083). Mean number of nodes taken for examination was 15 during the TLH surgery and 19 during laparotomy.

Postoperative complications were observed in 2 patients from the TLH and in 12 patients from the laparotomy groups (p=0.038). The most statistically significantly frequent complication in the laparotomy group was postoperative wound infection: 8 (19.05%) patients.

Conclusions: *Total laparoscopic hysterectomy with lymphadenectomy in endometrial cancer therapy is a safe and feasible procedure. It is characterized by significantly smaller percentage of complications and shorter hospital stay. This technique offers an alternative for laparotomy when it is performed by a highly experienced surgeon.*

Key words: **endometrial cancer** / **total laparoscopic hysterectomy with lymphadenectomy** / **safety** / **feasibility** /

Streszczenie

Cel pracy: *Ocena efektywności, skuteczności, bezpieczeństwa i wykonalności całkowitego laparoskopowego wycięcia macicy (TLH – total laparoscopic hysterectomy) z limfadenektomią w porównaniu z histerektomią na drodze laparotomii w terapii raka endometrialnego trzonu macicy.*

Materiał i metody: *Badaniem retrospektywnym objęto 31 kolejnych pacjentek z rakiem endometrium, u których przeprowadzono procedurę TLH z limfadenektomią oraz 42 pacjentki z rakiem endometrialnym operowanych metodą otwartą. W obu grupach analizowano: wiek, BMI, choroby towarzyszące, przebyte operacje, rodność, czas trwania operacji, utratę krwi (porównano morfologię wykonaną przed i po operacji) i potrzebę pooperacyjnej transfuzji krwi, czas hospitalizacji, rozmiary macicy, stopień zróżnicowania nowotworu i stopień zaawansowania raka endometrium (FIGO), oraz występowanie śród- i pooperacyjnych powikłań.*

Wyniki: *Średni wiek pacjentek poddanych TLH był niższy od wieku kobiet operowanych na drodze laparotomii i wynosił odpowiednio 54 i 64 (p=0,0001) Nie zaobserwowano natomiast znamiennych statycznie różnic w wartościach wskaźników BMI, objętości macicy, w rodności, w rozkładzie stopnia złośliwości histologicznej i stopnia zaawansowania raka endometrium w obydwu badanych grupach. Odsetek pacjentek z dodatkowymi chorobami przewlekłymi, operowanych techniką TLH był niższy niż wśród kobiet poddanych procedurze laparotomii i stanowił odpowiednio: 48,39% i 83,34% (p=0,032). Laparotomia w wywiadzie u pacjentek nie była związana z rodzajem zastosowanej techniki operacyjnej. Średni czas trwania operacji był krótszy w przypadku laparotomii niż przypadku laparoskopii i wynosił odpowiednio 130,6 i 151,77 (p=0,003) Większa utrata krwi podczas zabiegu związana była z wykonaniem laparotomii. Średni czas hospitalizacji po zastosowaniu metody laparoskopowej wynosił 4 dni i był krótszy niż po wykonaniu procedury laparotomii – 9 dni (p=0,0001). Powikłania w wyniku przeprowadzonych zabiegów wystąpiły u 2 pacjentek poddanych laparoskopii oraz u 12 kobiet operowanych techniką laparotomii (p=0,038). Najczęstszym powikłaniem występującym w grupie poddanej procedurze laparotomii było zakażenie rany pooperacyjnej i wystąpiło ono u 8 pacjentek.*

Wnioski: *Całkowite laparoskopowe wycięcie macicy z limfadenektomią w terapii raka endometrium stanowi procedurę bezpieczną i wykonalną. Ponadto charakteryzuje się znamiennie mniejszym odsetkiem powikłań, a także krótszym czasem hospitalizacji. Technika ta jest doskonałą alternatywą dla laparotomii w przypadku gdy wykonywana jest przez dobrze wyszkolonego operatora.*

Słowa kluczowe: **rak endometrium** / **całkowite laparoskopowe wycięcie macicy z limfadenektomią** / **bezpieczeństwo** / **wykonalność** /

Introduction

Abdominal total hysterectomy with bilateral adnexectomy, intra-operative peritoneal washing, and also lymphadenectomy in case of high risk of pelvic and para-aortic nodal metastasis, constitute the traditional management of endometrial cancer [1, 2, 3]. Unfortunately, many patients with endometrial cancer also suffer from accompanying diseases, i.e. obesity, hypertension, or diabetes, and in such cases the abdominal approach results in an increased risk of complications [1, 4, 5]. Vaginal hysterectomy was supposed to become an alternative surgical technique for patients suffering from the above diseases. However, such surgery does not allow for precise evaluation of the abdominal cavity, lymphadenectomy or intra-operative peritoneal washing. [6]. The laparoscopic approach is free of the above limitations, and, at the same time, diminishes the risk of complications occurring during laparotomy [7, 8].

Initially, laparoscopic-assisted vaginal hysterectomy (LAVH) with lymphadenectomy was performed as an alternative of laparotomy in case of endometrial cancer. This procedure provides comparable therapeutic effects to laparotomy, at the same time resulting in the decrease of the number of complications [1, 9, 11]. Unfortunately, it demanded the application of two

surgical procedures: laparoscopic and vaginal, which prolonged the duration of the surgery. Nowadays, total laparoscopic hysterectomy (TLH) with lymphadenectomy is used more often due to the fact that it requires only the laparoscopic approach.

Currently, numerous publications report about the safety, feasibility and benefits of applying the TLH procedure with lymphadenectomy in the management of endometrial cancer in comparison to the traditional management, i.e. shorter hospital stay, fewer complications, less blood loss, a better cosmetic result, possibility of implementing the complimentary treatment faster [11, 12, 13, 14, 15,16]. Despite all these facts, there is a great number of gynecologists in the world who remain skeptic about laparoscopy in the treatment of endometrial cancer.

Aim

The aim of the work was to assess the effectiveness, efficacy, safety and feasibility of total laparoscopic hysterectomy with lymphadenectomy in comparison to hysterectomy performed by laparotomy in the treatment of endometrial cancer.

Material and methods

73 patients with cancer of the endometrium (only patients with endometrioid adenocarcinoma were selected) hospitalized at The Department of Surgical and Endoscopic Gynecology, Polish Mother's Memorial Hospital – Research Institute (Lodz, Poland) were included in the study between in the years 2008-2010. Pelvic lymphadenectomy was performed in all study participants independently of grade assessed on the basis of preoperative histopathological results of the uterine cavity curettage. Total laparoscopic hysterectomy with lymphadenectomy was performed in 31 of them, whereas 42 were subjected to total hysterectomy with lymphadenectomy by laparotomy. Both groups of patients were compared analyzing the following parameters: age, BMI, accompanying diseases, previous surgeries, parity, duration of the surgery, blood loss and the necessity of postoperative blood transfusion, duration of hospital stay, size of the uterus in preoperative USG examination, result of postoperative histopathological examination, grading and staging according to FIGO, and also the number of lymph nodes taken for examination. Blood loss during the operation was measured by comparing complete blood count results from before and after the operation (the differences between the values, i.e. hemoglobin and hematocrit before and after the surgery, were compared). Complications were divided into intra-operative, i.e. occurring during the surgery and postoperative, i.e. occurring during postoperative hospital stay. Before the operation every patient had ultrasonographic examination of reproductive organs evaluating the size of the uterus and also pathologies co-occurring in the reproductive organs, such as uterine myoma (only small myomas, 10-30 mm in diameter, occurred in both groups), adnexal pathologies (defined as solid adnexal tumors 15-60 mm in diameter, and ovarian cysts 20-50 mm in diameter). The size of the uterus was compared by calculating its volume with the following formula: $4/3 x \Pi x (L x W x AP):2$ (L= uterus length, W=width, AP= anterior-posterior dimension), on the basis of the preoperative USG [17]. All patients had a preoperatively confirmed diagnosis of endometrial cancer on the basis of histopathological results of the uterine cavity curettage confirmed in our hospital. The exclusion criteria were: different results than endometrioid adenocarcinoma obtained from preoperative histopathological results of the uterine cavity curettage, earlier surgeries due to malignant neoplasm of reproductive organs, co-occurrence of other malignant neoplasms of the reproductive organs, and also previous chemo- and radiotherapy. Moreover, patients who underwent para-aortic lymphadenectomy, and patients who underwent the TLH before 2008 (when our team was still in the process of learning the procedure) were excluded from the study. All study participants were initially selected for the TLH, bilateral adnexectomy, and pelvic lymphadenectomy, but 42 patients were excluded from the laparoscopic procedure due to the anesthetic and cardiological contraindications to general anesthesia and also to placing the patient in the Trendelenburg position. These patients underwent laparotomy. Contraindications were based on preoperative cardiology and anesthesia consultations and they included: cardiopulmonary disease defined as a history of decompensated heart failure, myocardial infraction, unstable angina and poorly controlled HA. Moreover, one patient was excluded from the TLH surgery due to pathological changes in the throat and larynx (contraindications to general anesthesia) and underwent laparotomy instead.

The data were analyzed using STATISTICA 6.0. The statistic analysis was made using Student's t-test and ANOVA/MANOVA test for measurable parameters, fulfilling the assumptions of normal distributions and homogeneity of variance (the Shapiro-Wilk and the Levene/Brown-Forsythe tests were used, respectively). Whereas for parameters not fulfilling the above assumptions, U Mann and Whitney tests were applied, and also test of chi^2, chi^2 with Yates's correction and V^2 test in the case of non-measurable characteristics. Statistical analysis was carried out at the statistical significance level of $\alpha=0.05$ and probability of error $p<0.05$.

TLH with lymphadenectomy: procedure description

The day before the surgery all patients were adequately prepared (enema and subcutaneous micro fractional heparin injection for antithrombotic prophylaxis). The patients received 1.5 cefuroxime and 0.5 metronidazole in the middle of the procedure. The surgery was performed in intra-tracheal general anesthesia.

The Hohl uterine manipulator was used during the procedure. The Foley catheter was placed in the urinary bladder. The main trocar and 30^0 laparoscope were introduced transumbilically. Three 5-mm working trocars were used; two of them medially to the iliac spine and one in the median line, 8 cm below the umbilicus. Washings from peritoneal cavity were taken from all patients for cytological examination. The surgery was started with coagulation of the abdominal ostium of the uterine tube in order to avoid neoplasm dissemination. Bipolar coagulation and bipolar section (BiSect ERBE) were used to cut round ligaments and laminae of the broad ligament of the uterus were delaminated along the iliac vessels. Next, the iliac lymph nodes packets, external, internal and obturator, were bilaterally prepared and removed. The next stage consisted of dissecting the infundibulopelvic ligaments, as well as coagulating and dissecting of the parametrium and paracolpium tissues (including the pelvic artery). In order to achieve this, the vessel sealing system ThermoStapler (EMED) or BiClamp (ERBE) were used. The final stage of the operation consisted of taking out the uterus

with the outer edges (margins), using the monopolar hook with a sucking tunnel. Colpotomy was performed on the edge of a sealing adaptor of the Hohl manipulator. After total dissection of the uterus from the vagina, it was evacuated via the vaginal tract; the same was applied while removing the lymph nodes. The samples were sent for histopathological examination. The vagina was sutured laparoscopically with running suture. The Redon drain was placen in the peritoneal cavity. In all laparoscopic operations the main surgeon was AM.

Total hysterectomy by laparotomy

Twenty women underwent laparotomy through the midline incision, and 22 through the Pfannenstiel incision. All patients were adequately prepared for the surgery, i.e. enema and subcutaneous micro fractional heparin injection for antithrombotic prophylaxis on the day before the procedure. Intra-operationally, the patients were administered 1.5g of cefuroxime, intravenously. Surgical procedures were performed in a typical way. In all laparotomies main surgeons were AM and GB.

Results

Thirty one (42.47%) patients underwent total laparoscopic hysterectomy with lymphadenectomy and 42 (57.53%) women were operated by laparotomy. Patient population and the results are presented in Table I. Mean age of patients subjected to TLH was statistically significantly lower than the age of women operated by laparotomy (54 and 64 years, respectively). No statistically significant differences in the BMI values in both studied groups were observed. Mean BMI for women operated by the laparoscopic method was 29.40, and for the second group it was 31.71. In order to perform more precise analysis of the above parameter, the patients were divided into the following groups: proper BMI index (18.5-25.0), overweight (25.1-30.0),

first degree of obesity (30.1-35.0), second degree of obesity (35.1-40.0), and third degree of obesity ($\geq$ 40.1). Despite the lack of statistically significant differences (0.329), the percentage of overweight and first-degree obesity patients was slightly higher in the case of women operated by laparotomy (28.57% - overweight, 38.10% – first-degree obesity) than in the group who underwent the TLH procedure (25.81% - overweight, 29.03% - first-degree obesity) (Table II).

Moreover, preoperative results of the USG examinations of the reproductive organs were assessed, comparing the values of the uterine volume, presence of uterine myomas, and the incidence of pathologies in the adnexa. No statistically significant differences were observed. (Table I)

Patients in both groups were divided into parous and nulliparous but no statistically significant differences were observed (p=0.226). The percentage of nulliparous women in the group subjected to the TLH procedure was 22.58%, and in the second group – 9.52%. The percentage of parous patients in the laparoscopy and the TLH groups was 77.42% and 90.48%, respectively. Distribution of co-existing diseases, on the other hand, was statistically significantly different in the groups of women subjected to laparotomy and laparoscopy (p=0.032) (Table III).

The most prevalent chronic diseases were: hypertension, diabetes and heart diseases. The percentage of patients with additional chronic diseases in the TLH group was significantly lower than among women subjected to laparotomy (48.39% and 83.34%, respectively).

Previous laparotomies in both groups were not connected with the kind of the operational technique applied in our study (p=0.704). The percentage of patients subjected to earlier surgery via the abdominal access was small in both groups (6.45% – laparoscopy and 11.90% – laparotomy).

Table I. Patient population.

Evaluated parameter	TLH 31 (42.47%)	Laparotomy 42 (57.53 %)	P	Test
Mean age **Min-max**	54 (32-71)	64 (37-82)	0.0001	T-Student
BMI (mean) **Min-max** **Median**	29.40 (19.68-37.47) 30.41	31.71 (20.83-58.59) 31.24	0.257	M-W
Uterine volume in cm3 **Min-max** **Median**	68.45 (9.58-227.29) 56.47	113.28 (16.11-112.83) 54.22	0.779	M-W
Uterine myoma **No. of patients** **Percentage of patients**	7 22.58 %	13 30.95%	0.523	V²
Pathologies in adnexa **No. of patients** **Percentage of patients**	1 3.23%	4 9.52%	0.606	chi² with Yates's correction
Parity			0.226	chi² with Yates's correction
Nulliparous **No. of patients** **percentage**	7 22.58%	4 9.52%		
Parous **No. of patients** **percentage**	24 77.42%	38 90.48%		

min –max – minimum and maximum; TLH – total laparoscopic hysterectomy; M-W – U Mann Whitney's test; BMI – body mass index

Malinowski A, et al. *Evaluation of total laparoscopic hysterectomy with lymphadenectomy in surgical treatment of endometrial cancers.*

Table II. Evaluation of BMI.

Evaluated parameter	TLH 31 (42.47%)	Laparotomy 42 (57.53 %)	P	Test
BMI			p=0.329	chi²
Proper BMI (18.5–25.0) No. of patients percentage	7 22.58%	6 16.29%		
Overweight (25.10-30.00) No. of patients percentage	8 25.81%	12 28.57%		
Obesity I (30.10-35.00) No. of patients percentage	9 29.03%	16 38.10%		
Obesity II (35.10-40.00) No. of patients percentage	7 22.58%	5 11.91%		
Obesity III (≥40.10) No. of patients percentage	0 00.00%	3 7.14%		

TLH – total laparoscopic hysterectomy

Table III. Evaluation of coexisting diseases and earlier laparotomy surgeries.

Evaluated parameter	TLH 31 (42.47%)	Laparotomy 42 (57.53 %)	P	Test
Co-existing diseases	15 48.39%	35 83.34%	0.032	chi²
None No. of patients percentage	16 51.61%	7 16.67%		
HA No. of patients percentage	7 22.58%	11 26.19%		
HA, DM, Heart dis. No. of patients percentage	1 3.23%	2 4.76%		
HA, DM No. of patients percentage	4 12.90%	5 11.91%		
HA, Heart dis. No. of patients percentage	3 9.68%	13 30.95%		
Heart dis. No. of patients percentage	0 0.00%	3 7.14%		
DM No. of patients percentage	0 0.00%	1 2.38%		
Prev. laparotomy No. of patients percentage	2 6.45%	5 11.91%	0.704	chi² with Yates`s correction

Heart dis. – heart disease; HA – hypertension; DM – diabetes mellitus; TLH – total laparoscopic hysterectomy; Prev. - previously

The results of histopathological examinations of the samples taken during the surgery were also analyzed (Tables IV and V). The distribution of grading and staging (FIGO) was evaluated. No statistically significant differences were noted (p=0.130 – grading; p=0.857 – FIGO). The highest percentage of patients in both studied groups had grade GI of malignancy and was: 58.07% for the group subjected to laparoscopy and 54.76% for the women operated via the abdominal access. The percentage of patients with G2 was 41.94% in the laparoscopy and 33.33% in laparotomy groups. G3 cancer was not found in the TLH group and in 11.91% of women from the second group.

As far as the stage of endometrial cancer (FIGO) was concerned, the highest percentage of patients in both groups had IA grade (64.52% for the women after laparoscopy and 59.52% for women operated via the abdominal access). Grades IV, IIC2 and IIIA were not found in both analyzed groups.

Malinowski A, et al. *Evaluation of total laparoscopic hysterectomy with lymphadenectomy in surgical treatment of endometrial cancers.*

Table IV. Analysis of grading.

Evaluated parameter	TLH 31 (42.47%)	Laparotomy 42 (57.53 %)	P	Test
Grade			0.130	chi²
G1 No. of patients percentage	18 58.07%	23 54.76%		
G2 No. of patients percentage	13 41.94%	14 33.33%		
G3 No. of patients percentage	0 0.00%	5 11.91%		

TLH – total laparoscopic hysterectomy

Table V. Analysis of endometrial cancer staging (FIGO).

Evaluated parameter	TLH 31 (42.47%)	Laparotomy 42 (57.53 %)	P	Test
FIGO			0.857	chi²
IA No. of patients percentage	20 64.52%	25 59.52%		
IB No. of patients percentage	4 12.90%	5 11.91%		
II No. of patients percentage	6 19.36%	8 19.05%		
IIIA No. of patients percentage	0 0.00%	0 0.00%		
IIIB No. of patients percentage	0 0.00%	1 2.38%		
III C1 No. of patients percentage	1 3.23%	3 7.14%		
III C2 No. of patients percentage	0 0.00%	0 0.00%		
IV No. of patients percentage	0 0.00%	0 0.00%		

TLH – total laparoscopic hysterectomy

Operational data are presented in Table VI. Mean duration of the surgery was significantly shorter in case of the abdominal access technique than laparoscopy (130.6 min and 151.77 min, respectively; p=0.003). In order to expand the analysis, the relation between the duration of surgery and the BMI value, occurrence of other pathologies in the reproductive organs (i.e. uterine myoma or pathologies in the adnexa), as well as the kind of the operational technique used, were also evaluated (Table VII). The aim of the abovementioned analysis was to precisely determine the factors that had the decisive influence on prolonging the surgery with the TLH technique.

The results presented in Table VII demonstrate that only the kind of operational technique applied had statistically significant influence on the duration of surgery. Other factors proved to be insignificant.

Statistically significantly greater blood loss during surgery confirmed by evaluating the distribution of the Hb concentration and the Hct values before and after the surgeries was related to laparotomy. A statistically significantly higher drop of Hb concentration and the Hct value was observed in the group operated via the abdominal access than in the group after laparoscopy (mean values were: Hb-1.17g/dl, Hct-3.49% for the TLH technique and Hb-1.8g/dl Hct-5.47% for laparotomy; p=0.011-Hb; p=0.003-Hct).The number of patients requiring postoperative blood transfusion was not statistically significant (p=0.967) and was: 2 (6.45%) among women after laparoscopy and 4 (9.52%) in the group subjected to the abdominal access technique.

Mean duration of hospital stay after laparoscopy was 4 days and was statistically significantly shorter than after laparotomy – 9 days (p=0.0001).

The influence of the operational technique on the number of pelvic lymph nodes taken for histopathological examination was evaluated as well. No statistically significant correlation between the number of lymph nodes taken for pathomorphological examination during the surgery and the operational technique was found (p=0.083). Mean number of nodes taken for examination during the TLH surgery was 15 and 19 during laparotomy.

Complications resulting from the surgeries occurred in 2 (6.45%) patients after laparoscopy and 12 (28.57%) after laparotomy and they were statistically significantly connected with the operational technique used (p=0.038). (Table VIII). The most prevalent and statistically significant complication occurring in the laparotomy group appeared to be postoperative wound infection: 8 (19.05%) patients (p=0.028).

This complication was not observed among women operated by the laparoscopic technique. In the study group, two patients suffered from intraoperational complications: 1 (3.23%) patient during laparoscopy – subcutaneous emphysema of the thorax and the neck, and 1 (2.38%) during laparotomy – atrial fibrillation. Moreover, in 1 (3.23%) patient after laparoscopy a postoperative complication - transient anuria requiring the administration of Furosemide – was observed. Other postoperative complications after laparotomy included urinary system infection - 1 (2.38%) patient, sciatic nerve paralysis – 1 (2.38%) patient, brown chyme vomiting for 8 days – 1 (2.38%) patient. Urinary bladder or ureter damage did not occur. In the laparoscopic group there were no cases of conversion to laparotomy.

Discussion

The first total laparoscopic hysterectomy with lymphadenectomy in a patient with endometrial cancer was performed in 1992 [8, 18]. The publication of the outcome of the innovative – at that time – operational method aroused a great interest among gynecologists. During the last few years a growing number of publications reported on the safety, feasibility, and also benefits of applying the TLH procedure with lymphadenectomy, i.e. shortened hospital stay, fewer complications, less blood loss and better cosmetic result [9, 10, 11, 16, 19, 20].

Magrina et al., suggest superiority of the laparoscopic

Malinowski A, et al. *Evaluation of total laparoscopic hysterectomy with lymphadenectomy in surgical treatment of endometrial cancers.*

Table VI. Analysis of operational data of patients.

Evaluated parameter	TLH 31(42.47%)	Laparotomy 42 (57.53 %)	P	Test
Duration of surgery (minutes) (m) **Min-max**	151.77 (100-260)	130.60 (95-200)	0.003	T-Student
Hospital stay (m) **Min-max** **Median**	4 (2-5 days) 4	9 (4-42 days) 8	0.0001	Test M-W
↓conc. Hb (g/dl)(m) **Min-max** **Median**	1.17 (0.1-2.8) 1.1	1.8 (0.3-4.2) 1,55	0.011	Test M-W
↓conc. Hct (%)(m) **Min-max** **Median**	3.49 (0.1-7.8) 3.8	5.47 (0.1-13.2) 4.95	0.003	T-Student
Blood transfusions **No. of patients Percentage of patients**	2 6.45%	4 9.52%	0.967	chi² with Yates`s correction
No. of lymph nodes taken **Min-max**	15 (7-25)	19 (1-51)	0.083	T-Student

TLH – total laparoscopic hysterectomy; Min–max – minimum – maximum value; M – mean value; Hb – hemoglobin; Hct – hematocrit; No. of lymph taken – number of lymph nodes taken

procedure due to its comparable efficacy in endometrial cancer therapy in comparison to abdominal-access surgery and a substantially lower number of complications [21].

At our Department the total laparoscopic hysterectomy with lymphadenectomy has been performed since 2006. Earlier, since 2003, laparoscopically assisted vaginal hysterectomy with lymphadenectomy was performed. Unfortunately, this technique prolonged the surgery considerably, as it required the application of two operational procedures: laparoscopic and vaginal. Total laparoscopic hysterectomy with lymphadenectomy eliminates the above limitations.

In our present study, statistically significant differences in age structure and distribution of chronic diseases were observed, what had not been confirmed by earlier publications [1, 11, 12, 22]. Only Obermair et al., achieved similar results concerning the age factor [14]. Data obtained by us are connected with anesthetic and cardiological contraindications to general anesthesia, with placing the patient in the Trendelenburg position and also with anesthetic recommendation of patients with serious chronic diseases for laparotomy and spinal anesthesia.

Endometrial cancer is usually connected with a high BMI index due to the fact that obesity in women after menopause constitutes one of the most important factors in the incidence of this neoplasm [23].

Traditionally, obesity used to be a contraindication to a laparoscopic procedure and in the study of Childers et al., it even constituted an exclusion criterion in case of a laparoscopic surgery [7]. In earlier publications, women subjected to laparoscopic procedures had a significantly lower BMI index than the patients operated by laparotomy [24, 25]. However, experiences of other authors indicate safety, feasibility and considerable benefits coming from applying the laparoscopic procedure in obese patients with endometrial cancer [26, 27, 28, 29]. In our study the BMI index did not influence the choice of operational method. No statistically significant differences in the values of BMI in both groups were observed.

Table VII. Analysis of factors influencing the duration of surgery.

Relation between the duration of surgery and:	Mean duration of surgery	P	Test
BMI		0.892	ANOVA/ MANOVA
Proper BMI (18,5–25,0)	146.15		
Overweight (25,10-30,00)	138.50		
Obesity I (30,10-35,00)	135.20		
Obesity II (35,10-40,00)	147.50		
Obesity III (≥40,10)	123.33		
Myoma		0.876	ANOVA/ MANOVA
Presence of myoma	137.50		
Absence of myoma	140.61		
Pathology in adnexa		0.587	ANOVA/ MANOVA
Pathologies	130.00		
No pathologies	140.30		
Kind of operation		0.016	ANOVA/ MANOVA
Laparotomy	130.60		
TLH	151.77		

TLH – total laparoscopic hysterectomy; m. – mean value; BMI – body mass index

Malinowski A, et al. *Evaluation of total laparoscopic hysterectomy with lymphadenectomy in surgical treatment of endometrial cancers.*

Table VIII. Evaluation of complications.

Evaluated parameter	TLH 31 (42.47%)	Laparotomy 42 (57.53 %)	P	Test
Complications no. of patients percentage	2 6.45%	12 28.57%	0.038	chi² with Yates`s correction
No complications No. of patients percentage	29 93.55%	30 71.43%		
Urinary system infection No. of patients percentage	0 0.00%	1 2.38%		
Brown chyme vomiting for 8 days No. of patients percentage	0 0.00%	1 2.38%		
Postoperative wound infection No. of patients percentage	0 0.00%	8 19.05%	0.028	chi² with Yates`s correction
Atria fibrillation during surgery No. of patients percentage	0 0.00%	1 2.38%		
Sciatic nerve paralysis No. of patients percentage	0 0.00%	1 2.38%		
Subcutaneous emphysema of the thorax and the neck No. of patients percentage	1 3.23%	0 0.00%		
Transient anuria (Furosemide) No. of patients percentage	1 3.23%	0 0.00%		
Urinary bladder and ureter injury No. of patients percentage	0 0.00%	0 0.00%		

TLH – total laparoscopic hysterectomy

In our study mean duration of surgery was statistically significantly lower in the case of abdominal access technique than in the case of laparoscopy and was: 130.6 min and 151.77, respectively. These results are comparable to the earlier publications of other authors. However, it should be mentioned that we achieved a substantially shorter mean duration of the TLH procedure than most other authors [1, 11, 12, 28]. Most probably, it was due to the fact that a total laparoscopic hysterectomy due to non-cancer-related causes was performed at our Department since 2004, so our team had already had considerable experience in this technique. Moreover, the laparoscopic lymphadenectomy was also already mastered by then, being performed, together with laparoscopic-assisted vaginal hysterectomy (LAVH), since 2003. What is more, TLH with lymphadenectomy had also been performed earlier (since 2006) but only data collected during the 3 years were analyzed in this study. We agree with the suggestion of Eltabbakh that shortened duration of laparoscopic surgery in women with endometrial cancer results from practice and experience [30].

We noted significantly lower blood loss and shorter hospital stay (about 5 days, on average) in the group of patients operated by laparoscopic surgery, what is confirmed by authors of earlier publications [1, 14, 31, 32, 33]. The number of patients requiring postoperative transfusion was not statistically significant.

Analysis of the number of lymph nodes taken during the surgery for histopathological examination did not reveal statistically significant differences in both studied groups. The study by Germignani et al., confirms our results, however, other publications report a significantly greater number of lymph nodes taken for examination during laparoscopy [25, 30].

There were no cases among our patients operated by laparoscopic surgery who required conversion to laparotomy. Earlier publications report the percentage of laparoscopic conversions to laparotomy to range from 2.5% to 22%, and this complication concerned mainly obese women [14, 25, 26, 28].

Other retrospective studies on populations that were more diverse regarding the BMI index noted a smaller percentage of conversions (2.5%–6%), which was mainly connected with technical difficulties caused by adhesions [14, 28].

Authors of available relevant publications agree that a significantly smaller percentage of complications results from applying laparoscopy procedures rather than laparotomy in endometrial cancer therapy [1, 22, 28].

Our results also confirm this theory. The percentage of complications resulting from the surgeries we performed was significantly statistically lower in case of the TLH technique comparing to laparotomy (6.45% vs. 28.57%, respectively). The most frequent complication was postoperative wound infection observed only in the group operated via the abdominal access and was probably connected with larger operative wounds. As a consequence, hospital stay was significantly prolonged. The percentage of other complications was low. Urinary bladder or ureter lesion did not occur in any group of patients operated at our Department. Similar results were obtained by other authors [1, 11, 14, 22, 28]. Contradictory findings were reported by Uccella et al. [33]. They observed urinary system damage in 4 (8%) patients after laparoscopy (3 cystostomies and 1 ureter damage) and in 5 (10.4%) from the group operated via the abdominal access. However, these differences were not statistically significant [33]. Also other authors found similar urinary system damage as Ucella et al. [12, 13, 28].

Current publications report the advantages of using the da Vinci surgical system in endometrial cancer treatment [34]. Unfortunately, only one da Vinci surgical system is available in Poland at the moment so the application of robotic surgery in our country is limited.

Conclusions

Total laparoscopic hysterectomy with lymphadenectomy in the treatment of endometrial cancer is a safe and feasible procedure. It is characterized by significantly smaller percentage of complications, better cosmetic result and shorter hospital stay. This technique is an alternative for laparotomy when it is performed by an experienced surgeon.

References

1. Kalogiannidis I, Lambrechts S, Amant F, [et al.]. Laparoscopy-assisted vaginal hysterectomy compared with abdominal hysterectomy in clinical stage I endometrial cancer: safety, recurrence, and long–term outcome. *Am J Obstet Gynecol.* 2007, 196, 248e1-248e8.

2. Amant F, Neven P, Moerman K, [et al.]. Endometrial cancer – seminar. *Lancet.* 2005, 366, 491-505.

3. Obrzut B, Obrzut M, Skręt-Magierło J, [et al.]. Value of intraoperative assessment of the depth of myometrial invasion in endometrial carcinoma. *Ginekol Pol.* 2008, 79, 404-409.

4. Tozzi R, Malur S, Koehler C, Schneider A. Analysis of morbidity in patients with endometrial cancer: is there a commitment to offer laparoscopy? *Gynecol Oncol.* 2005, 97, 4-9

5. Gottwald L, Chałubińska J, Moszyńska-Zielińska M, [et al.]. Endometrioid endometrial cancer – the prognostic value of selected clinical and pathological parameters. *Ginekol Pol.* 2011, 82, 743-748,

6. Bloss J, Berman M, Bloss L, Buller R. Use of vaginal hysterectomy for the management of stage I endometrial cancer in the medically compromised patient. *Gynecol Oncol* 1991, 40, 74-77.

7. Childers J, Brzechffa P, Hatch K, Surwit E. Laparoscopically assisted surgical staging (LASS) of endometrial cancer. *Gynecol Oncol.* 1993, 51, 33-38.

8. Childers J, Surwit E. Combined laparoscopy and vaginal surgery for management of two cases of stage I endometrial cancer. *Gynecol Oncol.* 1992, 45, 46-51.

9. Magrina J, Weaver A. Laparoscopic treatment of endometrial cancer: five years recurrence and survival rates. *Eur J Gynaecol Oncol.* 2004, 25, 439-441.

10. Zullo F, Palomba S, Russo T, [et al.]. A prospective randomized comparison between laparoscopic and laparotomic approaches in women with early stage endometrial cancer: a focus on a quality of life. *Am J Obstet Gynecol.* 2005, 193, 1344-1352.

11. Pellegrino A, Signorelli M, Fruscio R, [et al.]. Feasibility and morbidity of total laparoscopic radical hysterectomy with or without lymphadenectomy in obese women with stage I endometrial cancer. *Arch Gyneacol Obstet.* 2009, 279, 655-660.

12. Ghezzi F, Cromi A, Uccella S, [et al.]. Laparoscopic versus open surgery for endometrial cancer: a minimum 3-year follow-up study. *Ann Surg Oncol.* 2010, 17, 271–278.

13. Schindlbeck Ch, Klauser K, Dian D, [et al.]. Comparison of total laparoscopic, vaginal and abdominal hysterectomy. *Arch Gynecol Obstet.* 2008, 277, 331–337.

14. Obermair A, Manolitsas T, Leung L, [et al.]. Total laparoscopic hysterectomy for endometrial cancer: patterns of recurrence and survival. *Gynecol Oncol.* 2004, 92, 789–793.

15. Ramirez P, Slomovity B, Soliman P, [et al.]. Total laparoscopic radical hysterectomy and lymphadenectomy: The M.D. Anderson Cancer Experience. *Gynecol Oncol.* 2006, 102, 252–255.

16. Malinowski A, Pogoda K. Total laparoscopic radical hysterectomy and bilateral pelvic lymphadenectomy of cervical cancer stage Ib – case report. *Ginekol Pol.* 2012, 83, 136-140.

17. Kung F, Chang S. The relationship between ultrasonic volume and actual weight of pathologic uterus. *Gynecol Obstet Invest.* 1996, 42, 35-38.

18. Nezhat C, Nezhat F, Burrell M, [et al.]. Laparoscopic radical hysterectomy and laparoscopically assisted vaginal radical hysterectomy with pelvic and paraaortic node dissection. *J Gynecol Surg.* 1993, 9, 105-120.

19. Holub Z, Voracek J, Shomani A, [et al.]. A comparison of laparoscopic surgery with open procedure in endometrial cancer. *Eur J Gynec Oncol.* 1998, 9, 294-296.

20. Holub Z. The role of laparoscopy in the surgical treatment of endometrial cancer. *Clin Exp Obstet Gynecol.* 2003, 30, 7-12.

21. Magrina J. Outcomes of laparoscopic treatment for endometrial cancer. *Curr Opin Obstet Gynecol.* 2005, 17, 343-346.

22. Volpi E, Ferrero A, Jacomuzzi M, [et al.]. Laparoscopic treatment of endometrial cancer: feasibility and results. *J Gynecol Obstet Biol Reprod.* 2006, 124, 232-236.

23. Shoff S, Newcomb P. Diabetes, body size, and risk of endometrial cancer. *Am J Epidemiol.* 1998, 148, 234-240.

24. Frondrinier E, Rodier J, Morice P, [et al.]. Surgical treatment for endometrial adenocarcinoma: first approaches. Review of the literature. *Gynecol Obstet Fertil.* 2003, 31, 456-464.

25. Fram K. Laparoscopically assisted vaginal hysterectomy versus abdominal hysterectomy in stage I endometrial cancer. *Int Gynecol Cancer.* 2002, 12, 57-61.

26. Obermair A, Manolistas T, Leung Y, [et al.]. Total laparoscopic hysterectomy versus total abdominal hysterectomy for obese women with endometrial cancer. *Int J Gynecol Cancer.* 2005, 15, 319-324.

27. Holub Z, Bartos P, Jabor A, [et al.]. Laparoscopic surgery in obese women with endometrial cancer. *J Am Assoc Gynecol Laparosc.* 2000, 7, 83-88.

28. Kuoppala T, Thomas E, Heinonen P. Clinical outcome and complications of laparoscopic surgery compared with traditional surgery in women with endometrial cancer. *Arch Gyneacol Obstet.* 2004, 270, 25-30.

29. Yu C, Cutner A, Mould T, Olaitan A. Total laparoscopic hysterectomy as a primary surgical treatment for endometrial cancer in morbidly obese women. *BJOG.* 2005, 112, 115-117.

30. Eltabbakh G. Effect of surgeon`s experience on the surgical outcome of laparoscopic surgery for women with endometrial cancer. *Gynecol Oncol.* 2000, 78, 58-61.

31. Magrina J, Mutone N, Weaver A, [et al.]. Laparoscopic lymphadenectomy and vaginal or laparoscopic hysterectomy with bilateral salpingo-oophorectomy for endometrial cancer: morbidity and survival. *Am J Obstet Gynecol.* 1999, 181, 376-381.

32. Spirtos N, Eisenkop S, Schlaerth J, Buller R. 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.* 2002, 187, 340-348.

33. Uccella S, Laterza R, Ciravolo G,[et al.]. A comparison of urinary complications following total laparoscopic radical hysterectomy and laparoscopic pelvic lymphadenectomy to open surgery. *Gynecol Oncol.* 2007, 107, 147-149.

34. Seamon L, Cohn D, Valmadre S, [et al.]. Robotic hysterectomy and lymphadenectomy for endometrial cancer: technical aspects and details of success - the OhioState University method. *J Robotic Surg.* 2008, 2, 71-76.