



Surgical outcomes of laparoscopic trachelectomy following supracervical hysterectomy: a multicenter study

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Objective

To evaluate the feasibility, safety, and surgical outcomes of laparoscopic trachelectomy after supracervical hysterectomy.

Methods

This multicenter study was conducted at Tanta University, Benha University, and Aminah Laparoscopy Center (Benha, Egypt) from June 1, 2018 to October 31, 2021. Forty patients were recruited for this study and counseled on laparoscopic trachelectomy to treat their symptoms after supracervical hysterectomy. Furthermore, cervical biopsy was performed to detect and exclude any malignancy. Histopathological examination of cervical specimens was performed after surgery. Operative details and outcomes were recorded.

Results

The median age of the patients was 42 years (range, 38-47). The median body mass index was 25 years (range, 22-28). The median interval between hysterectomy and the clinical presentation was 4.40 years (range, 3.58-5.25). Most patients presented with abnormal vaginal discharge (40%) and bleeding (25%). Moreover, a cervical biopsy result revealed stump carcinoma in three cases (7.5%) that were excluded. The median operative time was 210 minutes (range, 170-220). The median blood loss was 270 mL (range, 220-320). Additionally, histopathological examinations revealed that chronic non-specific cervicitis was present in 54.05% of trachelectomy specimens. There were no significant differences between symptomatic and asymptomatic patients regarding operative outcomes, except adhesions, which were more significantly increased in symptomatic patients ($P=0.015$). Minimal complications, both operative and post-operative, were related to the procedure.

Conclusion

Although the operative time was long and adhesions were common during laparoscopic trachelectomy, the procedure was feasible and safe, with minimal complications.

Keywords: Laparoscopic trachelectomy; Cervical stump carcinoma; Surgical outcomes; Supra-cervical hysterectomy

Introduction

Many gynecologists believe in supracervical hysterectomy for many reasons, such as less intraoperative blood loss, reduced surgical time, prevention of postoperative lower urinary tract symptoms, maintenance of normal sexual function, and fewer postoperative complications [1]. On the other hand, supracervical hysterectomy has many complications, such as increasing the incidence of cervical cancer, requiring a long

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follow-up period, and may cause irregular bleeding. Many gynecologists do not advocate this type of hysterectomy, and the previously mentioned claims are not significant enough to recommend supracervical hysterectomy to be superior to total abdominal hysterectomy [2,3].

Many patients experience abnormal genital bleeding after supracervical hysterectomy owing to polyps, cervicitis, or more severe stump carcinoma. Cervical polyps may be indicative of cervical or endometrial pathologies. Recent studies have reported that cervical polyps were associated with premalignant lesions in 2% of cases, and more seriously, 0.3% were associated with malignant lesions [4,5]. Other common symptoms after supracervical hysterectomy are abnormal offensive discharge, chronic pelvic pain, and impaired sexuality. These patients seek medical advice to resolve their symptoms in gynecological or oncologic clinics [6].

The management of these patients requires proper assessment using ultrasound, magnetic resonance imaging, and biopsy before any surgical intervention. Multidisciplinary team management is ideal for these patients, including senior gynecologists, oncologists, urologists, and gastrointestinal surgeon [7].

This study assessed the feasibility, safety, and surgical outcomes of laparoscopic trachelectomy in symptomatic patients after supracervical hysterectomy and subsequent histopathological examinations.

Materials and methods

1. Study design and settings

This descriptive cross-sectional study was conducted at the departments of obstetrics and gynecology at Tanta University, Benha University, and Aminah Laparoscopy Center (Benha, Egypt), in the period from June 1, 2018 to October 31, 2021.

2. Forty patients

Who underwent supracervical hysterectomy were included in this study. The inclusion criteria were as follows: (a) symptomatic patients with pelvic pain, discharge, or bleeding; (b) non-symptomatic patients with an abnormal pap smear at their routine follow-up; and (c) preinvasive cervical lesions as cervical Intraepithelial Neoplasia. The exclusion criteria were: (a) any stage of cervical carcinoma, (b) presence of hydronephrosis or hydroureter, (c) unfit for laparoscopy, (d) no

previous cervical biopsy, and (e) refusal to participate in the current study.

3. Methods

A complete history was obtained from all patients, including age, parity, body mass index (BMI), indication for hysterectomy, place of hysterectomy, duration since hysterectomy (interval), main symptoms, and any associated medical condition. Pelvic examination was performed to assess the length and mobility of the cervix. Routine preoperative investigations, including laboratory tests and ultrasound examinations, were requested for all patients.

Before trachelectomy, cervical biopsy was performed in all cases to detect any malignancy. The biopsy was performed using punch biopsy forceps on an outpatient basis. Biopsy samples were sent to pathologists to examine for malignancy. Malignant patients were referred to oncologists and excluded from the study.

4. Preoperative preparation

Patients were instructed for an 8-hour fasting before the surgery. Gastrointestinal preparation in the form of bowel enema was performed twice: 12 hours and 6 hours before surgery. Patients were advised to consume Macroglol 3350 (Prepawest®; Western Pharmaceutical, Obour, Egypt) with one sachet dissolved in a liter of water and drunk in 1 hour twice with the last sachet 8 hours before surgery to ensure complete and empty gastrointestinal tract. Two or three units of cross-matched blood samples were prepared.

5. Operative details

The patients underwent surgery under general anesthesia. At the beginning of the surgery, an anesthesiologist inserted a nasogastric tube (Ryle's tube®; Ultramed, Cairo, Egypt) into the empty gastric contents and fluids.

Abdominal insufflation was performed using a closed method with a Verres needle at the Lee-Hwang point. Three ports were used: the first trocar (10 mm) was inserted at the Lee-Hwang point, and the other two ports (5 mm) were inserted in the midclavicular line two fingers above the anterior superior iliac spine, as shown in Fig. 1. If adhesions were encountered at these port sites, a Palmer's point port was inserted to facilitate adhesiolysis.

Adhesiolysis was performed using graspers and scissors or graspers and electrosurgical devices, either bipolar ves-

sel sealing (Ligasure®; Covidien, Mansfield, MA, USA) or harmonic scalpel (Harmonic ACE®; Ethicon, Cincinnati, OH, USA). After complete adhesiolysis, dissection of the bladder flap downward from the cervix was performed either harmonically or mechanically using electrosurgical devices (Fig. 2).

A Mangeshkar colpotomizer cup (Mangeshkar®; Golden Nimbus, India) was inserted vaginally and pushed upward (cephalad) to delineate the cervical stump. The stump was

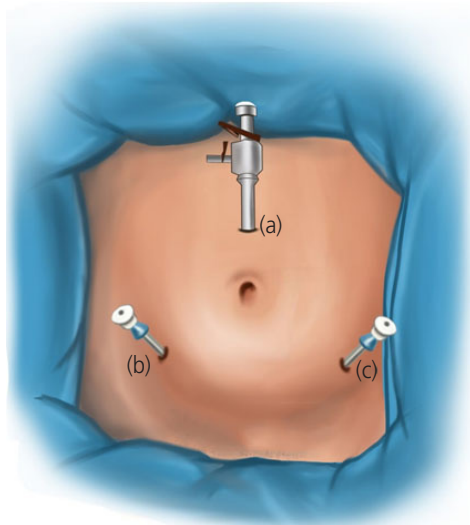


Fig. 1. Position of ports in laparoscopic trachelectomy (a) 10 mm port at Lee-Hwang point, (b) and (c) 5 mm port at midclavicular line, two fingers above the anterior superior iliac spines.

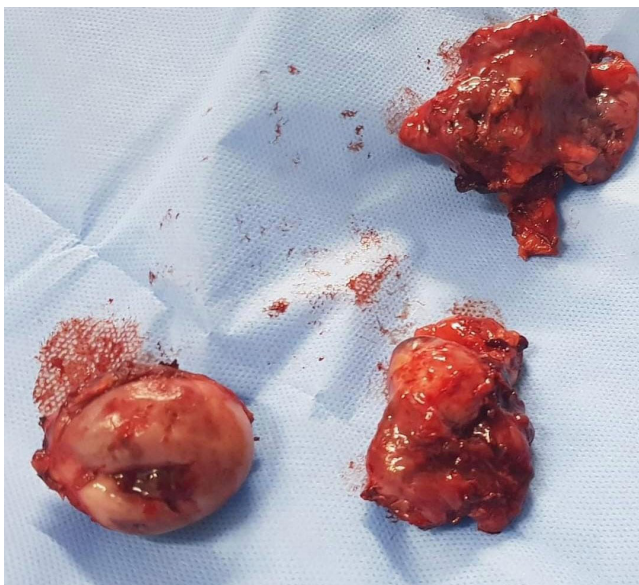


Fig. 2. Cervical stump and bilateral adnexa.

closed laparoscopically using either intracorporeal or extracorporeal knots. Dissection of the bladder flap up to 2-3 cm below the colpotomizer cup commenced, as shown in (b) of Fig. 1. The cervix was removed vaginally with a laparoscopic hook (monopolar current).

Inspection of the bowel for any injury or bleeding from the dissection was meticulously conducted. Any gastrointestinal tear or laceration was managed laparoscopically. The bladder was filled with 300 mL of saline with methylene blue to check for tears or leakage. The urologist repaired tears or injuries. An intraperitoneal drain was routinely administered to all the patients.

Formalin-fixed, paraffin-embedded blocks of cervical specimens were obtained from all the patients after trachelectomy for histopathological examination.

6. Postoperative care

Postoperative follow-up was conducted for vital signs, drains, urinary catheter, postoperative hemoglobin, ultrasound before discharge, and any complications.

7. Data collection

All data concerning demographic characteristics, history of hysterectomy, main symptoms, biopsy results, preoperative hemoglobin level, operative time, blood loss, intraoperative complications, postoperative hemoglobin, need for blood transfusion, intensive care unit stay, hospital stay, and any postoperative complications were collected.

Operative time was calculated by inserting all trocars to extract the last trocar in min. Blood loss was estimated using a quantitative method. Blood loss was calculated by summing all volumes in the suction bottles and subtracting the amount of saline used for irrigation and suction.

8. Ethical approval and study registration

This study was approved by the Tanta Ethical Committee (unique ID:32375/06/18) before enrollment. Written informed consent was obtained from all patients. The privacy and security of all patients were maintained throughout the study. Discussions about surgery and potential complications were discussed and declared to the patients.

9. Statistical methods

Statistical analyses were performed using R version 4.1.1 (R foundation for statistical computing, Vienna, Austria).

Normality of data was tested using the Shapiro-Wilk test. Numeric variables are presented as medians and interquartile ranges (IQRs), as they are not normally distributed. The Wilcoxon rank-sum test was used for non-parametric data. Categorical variables are presented as counts and percentages. Fisher's exact test was used to analyze categorical data. Statistical significance was set at $P < 0.05$. Correlations between variables were analyzed using Pearson's correlation coefficient. Linear and logistic regression analyses were used to explore predictors of the main outcomes.

Results

1. Basic demographic data of patients

The basic demographic data are presented in Table 1. The median age of the patients was 42 years (range, 38-47). The median BMI was 25 years (range, 22-28). Most of the patients were parous ($n=27$, 67.5%). Uterine fibroids were the most common cause of hysterectomy in 17 patients (42.5%), abnormal uterine bleeding was present in 11 (27.5%), and other indications are listed in Table 1. Approximately 45% of hysterectomy operations are performed in general hospitals. The median interval between hysterectomy and the clinical presentation was 4.40 years (range, 3.58-5.25). The main presentations and biopsy results are presented in Table 1. Three cases were found to be stump carcinomas, and were excluded and referred to gynecologic oncologists for staging and proper management. Cervical mobility was assessed in 31 patients (77.5%) with mobile cervix. The median cervical length was 37 mm (range, 30-40), as shown in Table 1.

2. Operative and postoperative data

Operative details and outcomes are presented in Table 2, where we compare the outcomes between symptomatic and asymptomatic cases. Most cases had abdominal and pelvic adhesions, either mild (40.54%) or extensive (37.84%), whereas 21.62% had no adhesions. The number of adhesions was significantly high in the symptomatic group ($P=0.015$). The median operative time for all patients was 210 minutes (range, 170-220), with a non-significant difference between the two groups ($P=0.192$). The median blood loss for all patients was 270 mL (range, 220-320), with no significant difference between the two groups ($P=0.534$). Most cases had no operative complications 35 (94.59%),

with a non-significant difference between the two groups ($P=0.399$). One case of bowel injury and 1 of bladder injury were observed in the symptomatic group. Concerning postoperative complications, there was no significant differ-

Table 1. Clinical characteristics of overall patients ($n=40$)

Characteristic	Overall, $n=40$
Age (yr)	42 (38-47)
BMI (kg/m^2)	25 (22-28)
Parity	
Nulliparous	13 (32.5%)
Parous	27 (67.5%)
Hysterectomy indication	
Fibroid	17 (42.5%)
Abnormal uterine bleeding	11 (27.5%)
Ovarian mass	3 (7.5%)
Endometriosis/adenomyosis	3 (7.5%)
PAS	6 (15.0%)
Place of hysterectomy	
General hospitals	18 (45.0%)
Private hospitals	12 (30.0%)
University hospitals	10 (25.0%)
Interval (yr)	4.40 (3.58-5.25)
Main presentation	
Vaginal discharge	16 (40.0%)
Vaginal bleeding	10 (25.0%)
Abnormal Pap smear	8 (20.0%)
Chronic pelvic pain	6 (15.0%)
Symptomatic patients	
Yes	32 (80.0%)
No	8 (20.0%)
Histopathology of cervical biopsy	
Chronic non-specific cervicitis	14 (35.0%)
Cervical adenomatous polyp	9 (22.5%)
Endometriosis	6 (15.0%)
CIN	8 (20.0%)
Stump carcinoma	3 (7.5%)
Cervical mobility	
Mobile	31 (77.5%)
Non mobile	9 (22.5%)
Cervical length (mm)	37 (30 - 40)

Values are presented as median (interquartile range) or number (%). BMI, body mass index; PAS, placenta accreta spectrum; CIN, cervical intra-epithelial neoplasia.

ence between the groups ($P=0.254$), as presented in Table 2. Postoperative hemoglobin and blood transfusions were not significantly different between the groups ($P=0.560$ and $P=0.624$, respectively). The median hospital stay was 4 days (range, 4-5), with a non-significant difference between the two groups ($P>0.999$). Histopathological examination of the specimens showed that chronic non-specific cervicitis was the most common pathological finding in more than half of the cases (54.05%). The pathological findings were not significantly different between groups ($P=0.307$). These pathological findings are presented in Figs. 3, 4.

The correlation matrix in Fig. 5 shows that blood loss has a weak positive correlation with age and BMI ($r=0.18$ and $P=0.17$, respectively) and a weak negative correlation with cervical length ($r=-0.31$). Operative time had a weak positive correlation with BMI and age ($r=0.35$ and 0.14 , respectively), and a weak negative correlation with cervical length ($r=-0.29$).

Regarding the regression analysis for operative time, extensive adhesions and increased BMI led to an increase in operative time ($P=0.03$ and 0.025 , respectively). Regarding the regression analysis for blood loss, it was found that

Table 2. Operative outcomes of symptomatic and asymptomatic patients with benign pathologies

Characteristic	Overall n=37	Asymptomatic n=7	Symptomatic n=30	P-value
Adhesions ^{b)}				
Extensive	14 (37.84)	0 (0.00)	14 (46.67)	0.015
Mild	15 (40.54)	6 (85.71)	9 (30.00)	
No	8 (21.62)	1 (14.29)	7 (23.33)	
Operative time (min) ^{a)}	210 (170-220)	180 (175-210)	210 (178-230)	0.192
Blood loss (mL) ^{a)}	270 (220-320)	260 (225-295)	275 (222-320)	0.534
Intraoperative complications ^{b)}				
No complications	35 (94.59)	7 (100.00)	28 (93.33%)	0.399
Bladder injury	1 (2.70)	0 (0.00)	1 (3.33%)	
Bowel injury	1 (2.70)	0 (0.00)	1 (3.33%)	
Postoperative complications ^{b)}				
No complications	24 (64.86)	3 (42.86)	21 (70.00)	0.254
UTI	7 (18.92)	3 (42.86)	8 (26.67)	
Blood transfusion	4 (10.81)	1 (14.86)	3 (10.00)	
Wound infection	2 (5.40)	1 (14.29)	1 (3.33)	
Postoperative Hb level ^{a)}	10.50 (9.40-11.20)	10.20 (9.35-10.50)	10.55 (9.40-11.28)	0.560
Blood transfusion ^{b)}				
1 Unit	2 (5.40)	1 (14.86)	1 (3.33)	0.624
2 Units	1 (2.70)	0 (0.00)	1 (3.33)	
3 Units	33 (89.19)	6 (85.71)	27 (90.00)	
No transfusion				
Hospital stay ^{a)}	4 (4-5)	4 (4-5)	4 (4-5)	>0.999
Histopathology examination ^{b)}				
Chronic non-specific cervicitis	20 (54.05)	5 (71.43)	15 (50.00)	0.307
Endometriosis	7 (18.92)	1 (14.29)	6 (20.00)	
CIN	10 (27.03)	4 (57.14)	6 (20.00)	

Values are presented as median cinterauartile range or number (%). UTI, urinary tract infections; CIN, cervical intra-epithelial neoplasia.

^{a)}Analyzed by Wilcoxon rank sum test.

^{b)}Analyzed by Fisher's exact test.

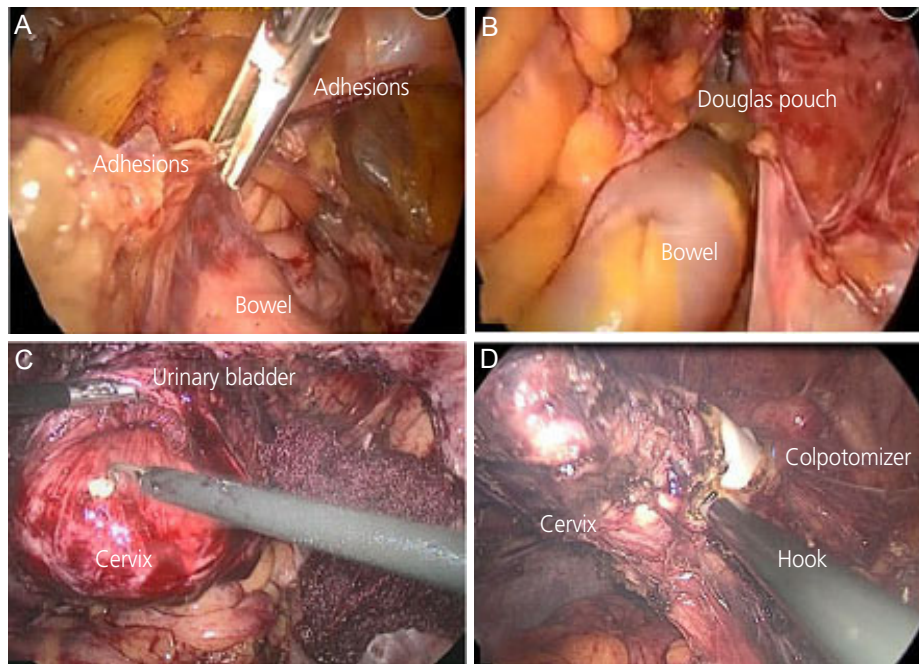


Fig. 3. (A) Adhesiolysis of omentum and bowel from lateral pelvic wall and cervical stump. (B) Douglas pouch free of adhesions. (C) Urinary bladder dissected downwards and colpotomizer pushed upwards to delineate the cervix. (D) Excision of the cervix by monopolar energy using hook.

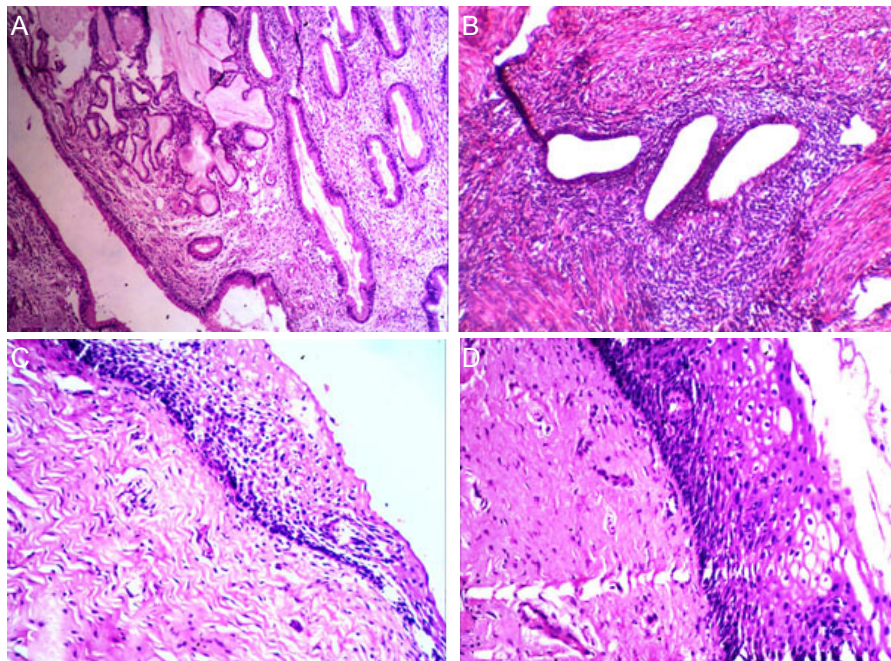


Fig. 4. (A) Chronic nonspecific cervicitis; endocervical mucosa with lymphocytic inflammation ($\times 100$). (B) Cervical endometriosis; a focus within the cervical stroma containing endometrial glands and stroma ($\times 200$). (C) CIN I; nuclear hyperchromasia and pleomorphism involving the lower one third of epithelium ($\times 400$). (D) CIN II; nuclear hyperchromasia and pleomorphism involving the lower 2/3rd of the epithelium ($\times 400$). CIN, cervical intraepithelial neoplasia.

women who suffered from endometriosis or had an ovarian mass at the time of hysterectomy had a significant increase in blood loss when adjusting for all other factors ($P=0.004$ and $P<0.001$, respectively). The unadjusted b coefficients of both endometriosis and ovarian masses were also significant ($P=0.002$ and $P=0.042$, respectively). Women who had mild or no adhesions had lower blood loss than those who had extensive adhesions and adjusted for all other factors, and the univariate b coefficients of both mild and no adhesions

were also significant. The results of the regression analysis are shown in Table 3.

Discussion

Preservation or removal of the cervix during hysterectomy is still a focus of controversy among gynecologists. Some gynecologists prefer supracervical hysterectomy because it

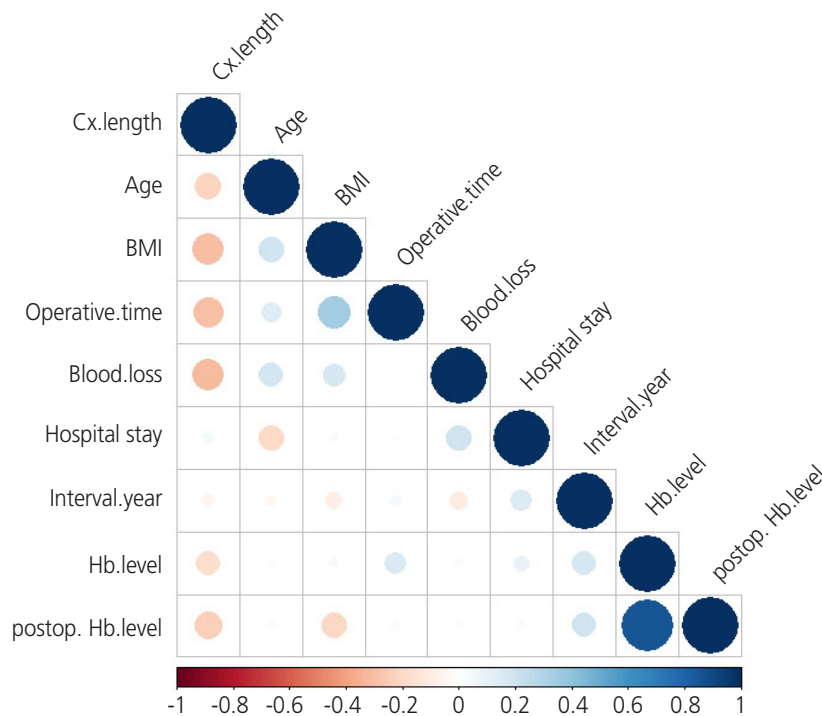


Fig. 5. Correlation matrix showing the correlation coefficients between other variables. Cx, cervical length; BMI, body mass index; Hb, hemoglobin.

Table 3. Multiple linear regression showing the predictors of operative time and blood loss

Characteristic	Univariate Linear R			Multivariate Linear R		
	Beta	95% CI ^{a)}	P-value	Beta	95% CI ^{a)}	P-value
Operative time						
Extensive adhesions	1.4	1.2, 4.0	0.03	1.5	-1.2, 4.2	0.3
BMI	4.6	0.61, 8.6	0.025	3.2	-1.1, 7.5	0.14
Blood loss						
Endometriosis at hysterectomy	142	57, 227	0.002	144	51, 236	0.004
Ovarian mass at hysterectomy	75	3.1, 148	0.042	140	71, 209	<0.001
Mild or no adhesions	-55	-103, -7.7	0.024	-162	-238, -86	<0.001

^{a)} CI, confidence interval; BMI, body mass index.

improves sexual and urinary functions. Other gynecologists disagree and prefer total hysterectomy because the above benefits have not been proven [8,9].

Although the risk of stump carcinoma after supracervical hysterectomy is approximately 2-5%, this type of hysterectomy requires continuous screening. A strict regular pap smear must be performed to screen for cervical stump carcinoma [10,11].

In the current study, 40 symptomatic patients with supracervical hysterectomy underwent laparoscopic trachelectomy. The median and IQRs for age and BMI were 42 years (range, 38-47) and 25 kg/m² (range, 22-28), respectively. Most patients underwent hysterectomy for fibroid uterus (42.5%) or abnormal uterine bleeding (27.5%). In a previous study conducted at Tanta University, the indications for supracervical hysterectomy were uterine myomas (46.92%) and abnormal uterine bleeding (28.46%) [12]. On the same side, Tsafrir et al. [13] conducted a retrospective study on 17 cases that underwent trachelectomy after supracervical hysterectomy compared with 68 cases with no trachelectomy. They found that the mean age was 43.5±9.5 years.

In the current study, the main presentations of the cases were abnormal vaginal discharge (40.0%), vaginal bleeding (25.0%), abnormal pap smear (20.0%), and chronic pelvic pain (15.0%). On the same side, Elbohuty et al. [12] reported that the most common symptoms after supracervical hysterectomy were abnormal vaginal discharge and vaginal bleeding in 11.54% and 8.46% of cases, respectively. Andersen et al. [14] followed up cases of supracervical hysterectomy for 5 years and reported that 11% of cases had persistent vaginal bleeding. A similar incidence of vaginal bleeding (11%) has been reported by Okaro et al. [15]. Another study reported a 24% incidence of vaginal bleeding and 2.1% of vaginal discharge in patients undergoing supracervical hysterectomy [16]. In a previous study conducted at Tanta University, the main presentations were different, wherein the first presentation was abnormal bleeding (40.9%), followed by chronic pelvic pain (18.9%), and the third presentation was abnormal vaginal discharge (16.7%) [17]. Tsafrir et al. [13] reported that the main indications for trachelectomy were chronic pelvic pain (70%), bleeding (59%), and pelvic mass (23%) among the reported cases.

The current study's median and IQR for the interval were 4.40 years (range, 3.58-5.25). Okaro et al. [15] studied 70 patients with a history of laparoscopic supracervical hyster-

ectomy. Seventeen patients (24.3%) were symptomatic after surgery. The interval was 14 months (range, 3-53). They operated on symptomatic patients via a laparoscopic trachelectomy. The pathological findings were normal cervical tissue in 35.3%, endometriosis in 23.5%, residual endometrium in 23.5%, and chronic cervicitis, mild CIN, and a mucocoele in the remaining 17.65% [15]. In a previous study conducted at Tanta University examining cervical biopsy of symptomatic patients after supracervical hysterectomy, the interval was 3.13±1.09 years (range, 0.5-6) [15]. In a previous study, the most common findings in cervical biopsy results were normal cervix (39.4%), CIN (24.2%), endometriosis (20.5%), chronic non-specific cervicitis (8.3%), squamous metaplasia (4.5%), and stump carcinoma (3.03%) [17]. Tsafrir et al. [13] reported a time interval of 28 months (approximately 2.25 years) between hysterectomy and presentation. They reported that the main pathologic findings were endometriosis (29%), chronic cervicitis (23%), uterine remnants (18%), normal cervix (18%), and other lesions (12%).

Nezhat et al. [18] operated on six symptomatic cases after supracervical hysterectomy, laparoscopically, to remove the cervical stump. They reported a mean blood loss of 100 mL (range, 50-200) and no major complications related to laparoscopic trachelectomy. In the current study, the median and IQR for blood loss were 270 mL (range, 220-320), which is greater than that reported by Nezhat et al. [18] owing to the large number of cases and the presence of adhesions in most cases. The median and IQR for the operative time were also relatively long, 210 minutes (range, 170-220). Vieira et al. [19] conducted a study to compare the operative outcomes of radical trachelectomy by open surgery versus minimally invasive surgery in an early cancer stump. They reported an operative time of 272 minutes (range, 130-441) for the minimally invasive group. They also reported minimal blood loss of approximately 50 mL (range, 10-225) in the minimally invasive group [19].

Recently, Lu et al. [20] compared laparoscopic radical trachelectomy with laparotomy in the early stages of cervical cancer. They allocated 58 patients to the laparoscopy group and 14 to the laparotomy group. They found that blood loss in the laparoscopic group was less than that in the laparotomy group (300.9 mL vs. 925 mL) [20].

The length of hospital stay in the current study was 4 days (range, 4-5). This was longer than that reported by Vieira et al. [19] who reported a short hospital stay of 1 day (range,

1-3) in the minimally invasive group. Histopathological examination of the specimens retrieved in our study revealed chronic non-specific cervicitis (54.05%), CIN (27.03%), and endometriosis (18.92%).

In the current study, the procedure was complicated by one case of bowel injury and one case of bladder injury. These patients were managed laparoscopically in the same setting. During the postoperative period, four patients required blood transfusion, seven had urinary tract infections, and two had wound infections. Similarly, Lu et al. [20] reported one case of bladder injury and six transfusions in the laparoscopic trachelectomy group. Vieira et al. [19] also reported one case of bladder injury and four cases of urinary tract infections in the postoperative period for the minimally invasive group.

Similarly, another study examined the removed cervixes for nerve fibers after trachelectomy. They found high proportion of nerve fibers in patients with chronic pelvic pain or endometriosis. They concluded that total hysterectomy was performed in these cases [21].

The strengths of this study were its prospective nature and the mandatory biopsy performed for all cases before trachelectomy. The small sample size, inability to include more asymptomatic cases, inability to include malignant cases following supracervical hysterectomy, inability to compare our technique with laparotomy or the vaginal approach, and a short follow-up period were the limitations of the study.

Laparoscopic trachelectomy after supracervical hysterectomy is feasible and safe. Few complications have been reported during the intraoperative or postoperative period.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Ethical approval

This study was approved by Tanta University Ethical Committee with the following unique ID:32375/06/18) before enrollment.

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Patient consent

Written informed consent was obtained from all patients.

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