

Persistent Bleeding After Laparoscopic Supracervical Hysterectomy

Kirsten J. Sasaki, MD, Aarathi Cholkeri-Singh, MD, Suela Sulo, MSc, Charles E. Miller, MD

ABSTRACT

Background and Objectives: In our clinical experience, there seemed to be a correlation between cervical stump bleeding and adenomyosis. Therefore, we wanted to conduct a study to determine whether there was an actual correlation and to identify other risk factors for persistent bleeding after a laparoscopic supracervical hysterectomy.

Methods: The study included women who underwent laparoscopic supracervical hysterectomy from January 1, 2003, through December 31, 2012. Data were collected on age, postmenopausal status, body mass index (BMI), uterine weight, indication for hysterectomy, concomitant bilateral salpingo-oophorectomy (BSO), presence of endometriosis, surgical ablation of the endocervix, adenomyosis, presence of endocervix in the specimen, and postoperative bleeding.

Results: The study included 256 patients, of whom 187 had no postoperative bleeding after the operation, 40 had bleeding within 12 weeks, and 29 had bleeding after 12 weeks. The 3 groups were comparable in BMI, postmenopausal status, uterine weight, indication for hysterectomy, BSO, surgical ablation of the endocervix, adenomyosis, and the presence of endocervix. However, patients who had postoperative bleeding at more than 12 weeks were significantly younger ($P = .002$) and had a higher rate of endometriosis ($P < .001$).

Conclusions: Risks factors for postoperative bleeding from the cervical stump include a younger age at the time of hysterectomy and the presence of endometriosis.

Department of Obstetrics and Gynecology, Advocate Lutheran General Hospital, Park Ridge, IL, USA (Drs Sasaki, Cholkeri-Singh, Miller).

James R. and Helen D. Russell Institute for Research and Innovation, Advocate Lutheran General Hospital, Park Ridge, IL, USA (Dr Sulo).

The authors have no conflicts of interest to report.

Portions of this study were presented at the 42nd Annual Global Congress on Minimally Invasive Gynecology, Washington, DC, November 10–14, 2013.

Address correspondence to: Kirsten J. Sasaki, Advocate Lutheran General Hospital, 1775 Dempster Street, Park Ridge, IL 60068, USA. Telephone: 847-723-8031, Fax: 847-723-1658, E-mail kirsasaki@gmail.com

DOI: 10.4293/JSLS.2014.002064

© 2014 by JSLS, Journal of the Society of Laparoendoscopic Surgeons. Published by the Society of Laparoendoscopic Surgeons, Inc.

Therefore, younger patients and those with endometriosis who desire to have no further vaginal bleeding may benefit from total hysterectomy over supracervical hysterectomy. All patients who are undergoing supracervical hysterectomy should be counseled about the possible alternatives, benefits, and risks, including continued vaginal bleeding from the cervical stump and the possibility of requiring future treatment and procedures.

Key Words: Cervical stump bleeding, laparoscopic supracervical hysterectomy.

INTRODUCTION

According to the U.S. Department of Health and Human Services, 600,000 hysterectomies are performed each year in the United States.¹ It is the second most common major operation that women undergo, and it is estimated that more than one-third of all women will have undergone the procedure by the age of 65.²

During supracervical hysterectomy, the surgeon removes only the body of the uterus; in a total hysterectomy, the surgeon removes the cervix along with the uterus. In the past, it was thought that leaving the cervix in place would result in improved sexual function and decreased rates of incontinence. A meta-analysis of 9 randomized controlled trials found that women who underwent supracervical or total hysterectomy for benign gynecologic conditions showed no postoperative difference with regard to sexual function or incontinence.¹ A retrospective analysis comparing perioperative outcome of laparoscopic total and supracervical hysterectomy found that total hysterectomy is associated with a higher risk of urinary tract injuries and a higher risk of conversion to laparotomy.³

Women who undergo supracervical hysterectomy are more likely to have postoperative vaginal bleeding from the cervical stump. Rates of persistent bleeding have been reported from 0.92% to 25% of cases,^{4–9} with most series reporting rates between 5% and 10%.¹⁰ Current research has been inconclusive regarding risk factors for persistent postoperative cervical stump bleeding. Some studies have identified endometriosis¹¹ and menorrhagia before hyster-

ectomy¹² as risk factors for postoperative bleeding, whereas a more recent study failed to demonstrate an association with endometriosis.¹³ Older age (especially >57 years)¹² and bilateral salpingo-oophorectomy (BSO) performed during the hysterectomy¹³ may in fact be preventative against postoperative bleeding, but only isolated studies have demonstrated these findings. Furthermore, the data on removal of the endocervix at the time of hysterectomy are inconsistent.^{9,12,14}

One condition that has been minimally studied with regard to postoperative cervical stump bleeding is adenomyosis, a histologic diagnosis made when endometrial glands and stroma are found within the myometrium of the uterus. This ectopic endometrial tissue induces smooth muscle cell hypertrophy that leads to a globally enlarged uterus and can cause symptoms of menorrhagia, pelvic pain, and dysmenorrhea.¹⁵ With supracervical hysterectomy, endometrial tissue may be left behind at the cervical stump, or fragments from morcellation could become implanted in the stump and cause postoperative vaginal bleeding. Given the scarcity of data related to adenomyosis and bleeding after laparoscopic supracervical hysterectomy, we conducted a retrospective study to determine what factors, including a pathologic diagnosis of adenomyosis, are associated with postoperative bleeding.

METHODS

The charts of patients who had undergone laparoscopic supracervical hysterectomy performed by either of 2 surgeons from January 1, 2003, through December 31, 2012, were reviewed. The patients were excluded if they had undergone a total laparoscopic hysterectomy, had no follow-up with the primary surgeon, or were lacking a record of a postoperative visit or a pathology report. This study was approved by the Advocate Health Care Institutional Review Board.

The electronic medical record was used to abstract the patient's age at the time of hysterectomy; postmenopausal status, defined as no menstrual period in the 12 months preceding the surgical procedure; body mass index (BMI), uterine weight, indication for hysterectomy in the operative note, concomitant BSO confirmed by pathology report, the presence of endometriosis in a pathology specimen, surgical ablation of the endocervix documented on the operative report, a pathology report of adenomyosis, and the presence of endocervical tissue in the specimen. Endometriosis was deemed to be present if found by pathology of a separate specimen of excised peritoneum

or on the serosa of the uterus, fallopian tubes, or ovaries. Documentation of postoperative bleeding was collected from office charts, including time of initiation, duration, resolution, and any medical or procedural intervention undertaken.

Patients

We used the procedure codes for laparoscopic supracervical hysterectomy, with and without BSO, and identified 368 charts. One hundred twelve charts were excluded because there was no documented postoperative follow-up appointment, leaving 256 patients (69.6%) in the analysis.

The subjects were categorized into 3 groups, no postoperative bleeding (group A), bleeding during the first 12 postoperative weeks (group B1), and bleeding at more than 12 weeks (group B2). Patients in whom bleeding started in the first 12 weeks after the operation and continued after 12 weeks or who were treated for bleeding after 12 weeks were included in group B2. Bleeding during the first 12 weeks, but not after, was considered to be normal during the postoperative healing period. The latter may be more clinically significant, as it can affect quality of life and may necessitate additional long-term treatment.

Statistical Analysis

Descriptive statistics were calculated for all data points, depending on distribution. Comparisons between the 3 groups were performed by 1-way analyses of variance (ANOVA) and Pearson χ^2 tests, with post hoc Tukey and Bonferroni corrections, respectively. Fisher's exact test was performed for comparison of treatment for postoperative bleeding between groups B1 and B2. Multinomial logistic regression was performed to calculate the odds ratio (OR) for pathology-identified endometriosis when bleeding was present. The correlation between age and endometriosis identified by pathology was assessed by Spearman correlation. All analyses were performed with SPSS for Windows, version 20.0 (SPSS Inc., Chicago, Illinois). A post hoc power calculation was also performed with endometriosis as the primary outcome of interest. The level of statistical power, which was calculated with PASS 11 (NCSS Statistical Software, Kaysville, Utah), was found to be 70%.

RESULTS

The patients' mean age was 45.2 years; 10 (3.9%) were postmenopausal. The median BMI was 25.7, and the me-

Table 1.
Comparison of Potential Risk Factors in the 3 Study Groups

Data	Group A (n = 187)	Group B1 (n = 40)	Group B2 (n = 29)	P
Age (years), mean (SD)	45.8 (5.9)	45.3 (7.3)	41.5 (5.7)	.002 ^a
Post-menopausal, n (%)	8 (4.3%)	2 (5%)	0 (%)	.503
BMI, median (95% CI)	25.4 (26.5–29.1)	27.1 (25.3–29.2)	24.8 (24.5–29.7)	.585
Uterine weight (g), median (95% CI)	221 (295.0–402.4)	187 (204.9–368.6)	171 (150.1–313.0)	.114
Indication for hysterectomy, n (%)				
Fibroid tumors	113 (60.4)	23 (57.5)	17 (58.6)	.935
Pelvic pain	18 (9.6)	8 (20)	6 (20.7)	.073
Dysfunctional uterine bleeding	32 (17.1)	7 (17.5)	4 (13.8)	.898
Other	15 (8)	2 (5)	2 (6.8)	.798
BSO, n (%)	30 (16)	6 (15)	3 (10.3)	.729
Endometriosis on pathology, n (%)	18 (9.6)	7 (17.5)	11 (37.9)	<.001 ^b
Endocervical ablation, n (%)	146 (78.1)	32 (80)	22 (78.6)	.964
Adenomyosis, n (%)	74 (39.6)	17 (42.5)	14 (48.3)	.661
Presence of endocervix, n (%)	25 (13.4)	10 (25)	3 (10.3)	.132
Surgeon, n (%)				
A	166 (88.8)	31 (77.5)	25 (86.2)	
B	21 (11.2)	9 (22.5)	4 (13.8)	.162

BMI, body mass index; BSO, bilateral salpingo-oophorectomy; CI, confidence interval.

Group A: no post-operative bleeding, group B1: bleeding ≤12 weeks, group B2: bleeding >12 weeks.

^aGroup A vs. B1, *P* = 1.000; group A vs. B2, *p* .001; group B1 vs. B2, *P* = .032.

^bGroup A vs. B1, *P* = .181; group A vs. B2, *p* < .001; group B1 vs. B2, *P* = .035.

dian uterine weight was 191 g. Of the 256 patients, 59.8% had fibroids, 12.5% had pelvic pain, and 16.8% had abnormal uterine bleeding as the primary indication for hysterectomy. The remaining patients (11.1%) had multiple indications or other indications for surgery. Most of the operations (86.7%) were performed by the senior author, and the remaining ones (13.3%) were performed by the second author. Only 15.2% of the patients underwent BSO at the time of hysterectomy, 14.1% had evidence of endometriosis reported by pathology, and 78.1% underwent surgical ablation of the endocervix. On the pathology report, 41% had evidence of adenomyosis, and 14.8% had endocervical tissue. Almost 27% had documented postoperative bleeding: 15.6% in group B1 and 11.3% in group B2.

Comparative results for the 3 groups are presented in **Table 1**. BMI, uterine weight, indication for hysterectomy, concurrent BSO, surgical ablation of the endocervix, and presence of endocervical tissue or adenomyosis reported

by pathology did not differ significantly between the 3 groups (*P* > 0.05). Postoperative bleeding was not significantly related to the surgeon (*P* = .162).

The mean age of the 3 groups was significantly different, with younger patients being at significantly higher risk of postoperative bleeding (*P* = .002). Post hoc analysis showed that there was no significant difference in mean age between the patients in groups A and B1 (*P* = .999). However, the patients in group B2 were significantly younger (41.5 ± 5.7 years) than those in groups A (45.8 ± 5.9 years) and B1 (45.3 ± 7.3 years) (*P* = 0.001 and 0.032, respectively). Furthermore, although the groups were not significantly different, no postmenopausal patients were found in group B2.

Comparative mean ages of the 3 study groups after the postmenopausal and BSO patients were removed are presented in **Table 2**. The mean age between groups was found to be statistically significant when the postmeno-

Table 2.
Mean Age of the 3 Study Groups With Postmenopausal and BSO Patients Removed

Data	Group A (n = 179)	Group B1 (n = 38)	Group B2 (n = 29)	P
Mean age (SD) (range) (postmenopausal patients removed)	45.3 (5.5) (25–59)	44.2 (5.8) (29–54)	41.5 (5.7) (25–54)	.002 ^a
	Group A (n = 153)	Group B1 (n = 34)	Group B2 (n = 26)	P
Mean age (SD) (range) (postmenopausal and BSO patients removed)	44.7 (4.9) (29–56)	43.4 (5.5) (29–51)	40.6 (5.3) (25–48)	.001 ^b

BSO, bilateral salpingo-oophorectomy.

^aGroup A vs. B1, $P = .511$; group A vs. B2, $P = .002$; group B1 vs. B2, $P = .109$.

^bGroup A vs. B1, $P = .348$; group A vs. B2, $p < .001$; group B1 vs. B2, $P = .086$.

pausal patients alone were removed from the analysis ($P = .002$). Post hoc analysis showed that there was no difference in mean age between groups A and B1 (45.3 ± 5.5 vs 44.2 ± 5.8 years; $P = .511$) or groups B1 and B2 (44.2 ± 5.8 vs 41.5 ± 5.7 years, $P = .109$); however, group B2 was significantly younger than group A (41.5 ± 5.7 vs 45.3 ± 5.5 years; $P = .002$). The results were similar when the postmenopausal and BSO patients were removed from the analysis.

An overall statistically significant difference was found between the 3 groups with regard to endometriosis on the pathology report ($P < .001$). Post hoc analyses showed no statistically significant difference between groups A (9.6%) and B1 (17.5%) ($P = .181$). Significantly more patients in group B2 (37.9%) had endometriosis than in groups A ($P < .001$) and B1 ($P = .035$). These results were confirmed by the regression model. More specifically, although the patients with endometriosis were more likely to have bleeding, endometriosis was found to be a non-statistically significant predictor when comparing groups A and B1 (OR = 0.53; 95% confidence interval [CI] = 0.21–1.37; $P = .191$). However, patients with endometriosis were more likely to bleed at more than 12 weeks than were those in group A (OR = 0.16; 95% CI = 0.01–0.41; $P < .001$) and group B1 (OR = 0.31; 95% CI = 0.10–0.95; $P = .040$). Finally, no statistically significant correlation was found between age and pathology report of endometriosis ($P = .174$).

The treatment methods used for the 2 groups with postoperative bleeding are presented in **Table 3**. The most common treatment for patients with postoperative bleeding included observation (40/69, 57.9%), with application of silver nitrate (15/69, 21.7%) being the next most common. Several patients (5/69, 7.2%) had silver nitrate and

Table 3.
Comparison of Treatment Approaches for All Patients With Postoperative Bleeding

Treatment n (%)	Group B1 (n = 40)	Group B2 (n = 29)	P
Observation	25 (62.5)	15 (51.7)	.371
Silver nitrate	7 (17.5)	8 (27.6)	.316
Silver nitrate, ferric subsulfate	3 (7.5)	1 (3.4)	.634
Silver nitrate, trachelectomy	0 (0)	1 (3.4)	.420
Ferric subsulfate	1 (2.5)	0 (0)	.996
Trachelectomy	1 (2.5)	2 (6.9)	.568
Medication	0 (0)	1 (3.4)	.420

ferric subsulfate (Monsel’s solution) applied, and 1 (1.4%) had only ferric subsulfate applied. Approximately 4.3% (3/69) underwent trachelectomy (13–26 months after hysterectomy) and 1 patient (1.4%) opted for medical treatment with oral contraceptives. There was no statistically significant difference in the treatment modalities used in groups B1 and B2 ($P > 0.05$).

DISCUSSION

Our study was focused on determining the risk factors associated with persistent cervical stump bleeding after laparoscopic supracervical hysterectomy. In the current literature, the risk factors for persistent postoperative bleeding are inconclusive.^{9,11–14} Furthermore, Lieng et al¹² discovered that only 50% of patients who underwent supracervical hysterectomy were aware that they could experience persistent postoperative menstrual bleeding.

After patients who experienced postoperative bleeding within 12 weeks of surgery were excluded, our rate of postoperative bleeding (11.3% of the cases) is consistent with published rates, which range from less than 1% to more than 25%. Some of these studies include any postoperative bleeding, whereas others document only cyclical vaginal bleeding.¹³ We included all patterns of postoperative bleeding, as all may reduce quality of life.

Only patients with documented follow-up were included in our study; this criterion prompted exclusion of approximately 30% of the patients who underwent laparoscopic supracervical hysterectomy during the study period. The low follow-up rate is due to the nature of the referral practice, as operations are often performed in conjunction with the referring physician, and not all patients have office follow-up. There are 2 ways that this failure may affect our rate of postoperative bleeding. The patients were instructed to follow up with the referral practice if problems occurred after the surgery; thus, the actual rate of postoperative bleeding may have been less than calculated, in that there may have been no follow up in patients with no bleeding. It is also possible that patients who experienced postoperative bleeding sought care elsewhere. Both of these possibilities may have influenced the reported rate of postoperative bleeding in the study sample.

One variable that has not been examined extensively in the literature is BMI as a risk factor in postoperative bleeding of the cervical stump. A higher BMI often indicates greater adiposity, which implies increased peripheral conversion of androgens to estrogen and possibly increased persistent bleeding caused by hormonal stimulation of any remaining endometrium. BMI was not found to be significantly different between the 3 groups, confirming the previous findings of Ghomi et al,¹³ who reported the data of 67 patients who underwent laparoscopic supracervical hysterectomy and were observed for 15 months.

There was no statistically significant difference between the 3 groups for indication of surgery and pathology report of adenomyosis. All of these findings are consistent with the data published by Ghomi et al.¹³ However, our findings differed, as they found that 24% of patients experienced postoperative bleeding when the ovaries were preserved, versus 0% after undergoing a BSO. Although only 39 of our patients underwent a BSO at the time of supracervical hysterectomy, their result was not confirmed by our findings. The persistent postoperative bleeding in patients despite concomitant BSO may have been caused

by peripheral conversion of androgens to estrogen or stimulation by ovarian remnants.

Many surgeons fulgurate the endocervical canal at the completion of hysterectomy in an attempt to ablate any possible remaining endometrium and prevent postoperative bleeding. In a meta-analysis, Nouri et al⁹ found that bipolar coagulation of the endocervical canal decreases rates of postoperative cyclical bleeding, but, similar to Ghomi et al,¹³ we were unable to confirm this finding. One limitation in the reliability of the data for this finding is that fulguration of the canal may have been performed but was not described in the operative note. However, no statistically significant difference was found between pathology for the 3 groups in terms of surgical ablation of the endocervical canal or endocervical tissue. Two studies demonstrated decreased rates of bleeding when endocervical tissue was present on the uterine specimen, but the difference was not statistically significant.^{13,14} Nouri et al⁹ demonstrated in a meta-analysis that uterine resection below the level of the internal os is protective against bleeding.⁹ This procedure is considered to be protective against persistent postoperative bleeding, as it could be inferred that the presence of endocervical tissue indicates that the entire lower uterine segment was excised, and no endometrial tissue was left in situ. A limitation of this finding is that one cannot assume that the amputation of the uterus from the cervix was uniform, nor is there an anatomic line between the cervix and the uterus. Therefore, at one level, some endocervical tissue may be excised, but at another area of the amputated endometrium, it may remain in situ.

Two variables were found to be more common among the patients who had postoperative bleeding at more than 12 weeks, younger age, and endometriosis. Patients who experienced postoperative bleeding at more than 12 weeks were significantly younger than those who did not and those who had postoperative bleeding within 12 weeks of the operation. This finding is consistent with the results reported by Lieng et al,¹² who performed a retrospective cohort study of 240 women and found that the older women were less likely to have postoperative menstrual bleeding persisting up to 3 years. Initially, it was thought that younger patients were less likely to have undergone a BSO at the time of surgery and to be postmenopausal before surgery, and, in them, ovulation therefore continued along with stimulation of any remaining endometrium, whereas the older patients underwent surgically or naturally induced menopause. After we removed postmenopausal and BSO patients from the analysis, the group with postoperative bleeding at more than

12 weeks was significantly younger than the group with no bleeding, but was not significantly younger than those with bleeding within the first 12 weeks. This finding may provide an additional tool for discussing the risks of persistent bleeding after laparoscopic supracervical hysterectomy, depending on the patient's age at the time of the operation.

A greater proportion of patients in the group with postoperative bleeding at more than 12 weeks had evidence of endometriosis at the time of surgery confirmed by pathology report. This result is consistent with findings by Okaro et al¹¹ in a retrospective study of 70 women who underwent laparoscopic supracervical hysterectomy and were observed up to 66 months. They found that 82% of the patients with postoperative cervical stump symptoms, whether it was pain or bleeding, had evidence of endometriosis, whereas 32% of those without such symptoms had evidence of endometriosis. A possible explanation is that tissue affected by endometriosis was left on the cervical stump during surgery, and as patients continued to produce estrogen, the ectopic endometrial tissue stimulated postoperative vaginal bleeding. Furthermore, there was evidence of cervical endometriosis in pathology and cytology specimens from Papanicolaou smears; thus, the presence of endometriosis in the cervix could cause persistent cervical stump bleeding.¹⁶ Other studies, however, have not demonstrated a correlation between endometriosis and cervical stump symptoms.¹³

As young age and endometriosis were both associated with postoperative bleeding beyond 12 weeks, we evaluated the possibility of a correlation between the 2 variables. We identified no significant correlation between young age and the presence of endometriosis; thus, each variable individually was associated with persistent postoperative bleeding in our patient population.

Although 11% of the patients experienced postoperative bleeding, it may be encouraging that, of those, only half needed treatment, perhaps because some women who experience bleeding do not regard it as bothersome. This conclusion confirms the findings of Lieng et al¹² that, although 24% of the women reported continued menstrual bleeding after supracervical hysterectomy, it was viewed as minimal by 90% of them, with a mean degree of adverse patient reaction of 1.13 on a 10-point visual analog scale. The extent and disturbance of the vaginal bleeding varies, but most patients undergo minimal intervention performed in the physician's office and few require an additional procedure such as a trachelectomy. In a study of 310 patients who underwent trachelectomy an

average of 26 years after supracervical hysterectomy, Hilger et al¹⁷ reported that more than 50% did so for prolapse and only 9% for bleeding. In our study, it is possible that those who were initially under observation after surgery were followed up elsewhere; thus, their treatment would not have been captured. Although the study was found to be powered at less than 80%, it included the largest sample size to date (compared with those in previous studies). Another significant strength of the study is that there were only 2 primary surgeons, thus eliminating differences between surgical technique and experience. Limitations include the retrospective design of the study, with reliance on medical charts to determine the presence or absence of postoperative bleeding, as well as findings and treatment. Future studies might include a prospective study with postoperative follow-up of patients at regular intervals with telephone calls or surveys, to ask them specifically about postoperative bleeding, treatment, and resolution.

In addition, as power morcellation of the excised uterus or fibroids is currently a matter for debate in the gynecologic community, we report that we had no cases of uterine leiomyosarcoma in our study sample. We currently counsel all patients regarding the potential risks and benefits of power morcellation, as well as the alternatives, and have successfully performed power morcellation in a bag under direct visualization in more than 50 patients, similar to the methods used in a recently published study.¹⁸

CONCLUSION

Supracervical hysterectomy is a surgical treatment option for many women. Most women experience no further menstrual bleeding after surgery, but there is the possibility of bleeding from the cervical stump. Younger patients and those with endometriosis who desire to have no further vaginal bleeding may benefit from having total rather than supracervical hysterectomy. All patients who undergo laparoscopic supracervical hysterectomy should be counseled about the possible alternatives, benefits, and risks, including continued vaginal bleeding from the cervical stump and the possibility of postoperative treatment and procedures.

References:

1. Lethaby A, Mukhopadhyay A, Naik R. Total versus subtotal hysterectomy for benign gynaecological conditions. *Cochrane Database Syst Rev.* 2012;4:CD004993.
2. Wilcox L, Koonin L, Pokras R, Strauss L, Xia Z, Peterson H. Hysterectomy in the United States, 1988–1990. *Obstet Gynecol.* 1994;83:549–555.

3. Harmanli O, Tunitsky E, Esin S, Cytal A, Knee A. A comparison of short-term outcomes between laparoscopic supracervical and total hysterectomy. *Am J Obstet Gynecol.* 2009;201:536.e1-e7.
4. Morrison J, Jacobs V. 437 Classic intrafascial supracervical hysterectomies in 8 years. *J Am Assoc Gynecol Laparosc.* 2001; 8:558–567.
5. Kim D, Bae D, Hur M, Kim S. Comparison of classic intrafascial supracervical hysterectomy with total laparoscopic and laparoscopic-assisted vaginal hysterectomy. *J Am Assoc Gynecol Laparosc.* 1998;5:253–260.
6. Gimbel H, Zobbe V, Andersen B, Filtenborg T, Gluud C, Tabor A. Randomised controlled trial of total compared with subtotal hysterectomy with one-year follow up results. *Br J Obstet Gynaecol.* 2003;110:1088–1098.
7. van der Stege J, van Beek J. Problems related to the cervical stump at follow-up in laparoscopic supracervical hysterectomy. *JLS.* 1999;3:5–7.
8. Van Winjgaarden W, Filshie M. Laparoscopic supracervical hysterectomy with Filshie clips. *J Am Assoc Gynecol Laparosc.* 2001;8:137–142.
9. Nouri K, Demmel M, Greilberger U, et al. Prospective cohort study and meta-analysis of cyclic bleeding after laparoscopic supracervical hysterectomy. *Int J Gynecol Obstet.* 2013;122:124–127.
10. Jenkins T. Laparoscopic supracervical hysterectomy. *Am J Obstet Gynecol.* 2004;191:1875–1884.
11. Okaro E, Jones K, Sutton C. Long term outcome following laparoscopic supracervical hysterectomy. *Br J Obstet Gynaecol.* 2001;108:1017–1020.
12. Lieng M, Qvigstad E, Istre O, Langebrekke A, Ballard K. Long term outcomes following laparoscopic supracervical hysterectomy. *Br J Obstet Gynaecol.* 2008;115:1605–1610.
13. Ghomi A, Hantes J, Lotze E. Incidence of cyclical bleeding after laparoscopic supracervical hysterectomy. *J Minim Invasive Gynecol.* 2005;12:201–205.
14. Schmidt T, Eren Y, Breidenback M, et al. Modifications of laparoscopic supracervical hysterectomy technique significantly reduces postoperative spotting. *J Minim Invasive Gynecol.* 2011; 1:81–84.
15. Garcia L, Isaacson K. Adenomyosis: review of the literature. *J Minim Invasive Gynecol.* 2011;18:428–437.
16. Baker P, Clement P, Bell D, Young R. Superficial endometriosis of the uterine cervix: a report of 20 cases of a process that may be confused with endocervical glandular dysplasia or adenocarcinoma in situ. *Int J Gynecol Pathol.* 1999;18:198–205.
17. Hilger W, Pizarro A, Magrina J. Removal of the retained cervical stump. *Am J Obstet Gynecol.* 2005;193:2117–2121.
18. Cohen S, Einarsson J, Wang K, et al. Contained power morcellation within an insufflated isolation bag. *Obstet Gynecol.* 2014;124:491–497.