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REVIEW ARTICLES

Laparoscopic supracervical hysterectomy

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KEY WORDS
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Laparoscopic supracervical hysterectomy is a minimally invasive procedure that was developed during the 1990s as a treatment for abnormal uterine bleeding. The literature regarding this procedure, mainly case series and retrospective comparisons, suggests that laparoscopic supracervical hysterectomy results in reduced operating time and blood loss and a quicker return to normal activity, compared with laparoscopic-assisted vaginal hysterectomy. A randomized, controlled trial that compared laparoscopic supracervical hysterectomy with hysteroscopic endometrial resection found that laparoscopic supracervical hysterectomy resulted in significantly better patient satisfaction at 2 years for similar costs. Unfortunately, there are no randomized trials that have compared laparoscopic supracervical hysterectomy to vaginal or abdominal hysterectomy. Given the lack of appropriate randomized, controlled trials and the limitations of the existing research, the laparoscopic supracervical hysterectomy's true value and appropriate clinical indications remain unknown. Well-designed randomized, controlled trials that compare laparoscopic supracervical hysterectomy with laparoscopic-assisted vaginal hysterectomy, total vaginal hysterectomy, and total abdominal hysterectomy, with attention to short- and long-term morbidity, postoperative vaginal bleeding, postoperative cervical disease, sexual function, urinary symptoms, and pelvic prolapse are needed. The purpose of this article was to review the existing literature regarding laparoscopic supracervical hysterectomy and to evaluate the evidence regarding the proposed risks and benefits of the procedure.

Before 1950, approximately 95% of the hysterectomies that were performed in the United States were performed with a supracervical approach.[1] This route was chosen because it avoided entry into the vagina, shortened the duration of anesthesia, and reduced the incidence of visceral and hemorrhagic complications. Further, it was felt to reduce the incidence of pelvic prolapse. However, during the 1940s, advances in medicine and surgical techniques resulted in a transition towards total hysterectomy. First, advances in the use of antibiotics led to a reduction in the morbidity that was associated with entering a clean, contaminated space (the vagina). Second, advances in anesthetic techniques resulted in reduced anesthesia-related morbidity and mortality rates. As a result, surgical morbidity became more dependent on the procedure itself and not the duration of anesthesia. Finally, improved surgical training and techniques made the removal of the cervix less dangerous. Hence, total hysterectomy became the standard of care in the second one half of the 20th century. Supracervical hysterectomy was then relegated to difficult hysterectomies or situations in which the surgeon's inexperience prohibited the removal of the cervix.[1]

One of the goals of the transition from supracervical hysterectomy to total hysterectomy was to reduce the

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incidence of cervical cancer. In the absence of an effective screening tool for cervical cancer, retention of the uterine cervix placed women at risk for subsequent malignancy. In 1941, Papanicolaou and Trout[2] published a landmark report on the use of the Papanicolaou test, which has revolutionized our ability to detect preinvasive cervical cancer. However, routine cervical screening did not become commonplace in the United States until the 1960s. The death rate from cervical cancer declined during the later one half of the 20th century, and many investigators have debated whether total hysterectomy or the Papanicolaou test alone was responsible for this decline.[3] In 1992, the Center for Disease Control released a comprehensive review on this subject that concluded that the Papanicolaou test was responsible for the greatest reduction in the death rate from cervical cancer. The authors felt that total hysterectomy could account for only 8% of the decline.[4]

The option of supracervical hysterectomy resurfaced in the 1990s because of the expanding technology and techniques of minimally invasive surgery. In 1989, Reich et al[5] performed the first laparoscopic-assisted vaginal hysterectomy (LAVH). In 1991, Semm described the first laparoscopic supracervical hysterectomy (classic abdominal Semm hysterectomy), which later became known as classic intrafascial supracervical hysterectomy (CISH).[6] During the subsequent decade, the development of new laparoscopic equipment made the procedure simpler and more accessible to gynecologists. Simultaneously, the Internet provided a medium to distribute information on the proposed benefits of supracervical hysterectomy. Patients, employers, and third-party payers have since begun to request minimally invasive procedures because of their shorter recovery periods and subsequent quicker return to work and activity. Finally, the extremely low incidence of cervical cancer in a screened population and the development of minimally invasive techniques to treat preinvasive lesions have made the removal of the cervix at the time of hysterectomy in low-risk patients more of a preference than a requirement. All of these forces have culminated in a renewed debate on the advantages and disadvantages of supracervical hysterectomy.

Advocates of laparoscopic supracervical hysterectomy (LSH) promote the following benefits of the procedure: minimally invasive nature, improved sexual function, fewer complications, fewer urinary symptoms, and conservation of the cervix with its ligamentous attachments.[7] Opponents of the reintroduction of supracervical hysterectomy discuss the persistent risk of cervical disease,[8] persistent vaginal bleeding,[9] complications involved with future surgery, and the costs that are associated with laparoscopic surgery.[10] We performed an LSH-specific literature review in an effort to identify and apply evidence-based criteria to current opinion. We searched PubMed, Medline, and Premedline from 1966 to 2003 using the terms *subtotal hysterectomy*, *laparoscopic subtotal hysterectomy*, *supracervical hysterectomy*, *laparoscopic supracervical hysterectomy*, *supravaginal hysterectomy*, *laparoscopic supravaginal hysterectomy*, *LASH procedure*, *LSH procedure*, and *SLH procedure*. Review of these articles and those articles that were referenced within them comprise the database that was used for this review. We have attempted to limit our focus to LSH; however, we have added data from open supracervical hysterectomy as noted.

Techniques

Numerous techniques have been described for the performance of an LSH. Most descriptions differ in 3 distinct areas: method of dissection and hemostasis, handling of the endocervix, and technique of removing the detached uterine corpus. Dissection and/or hemostasis may be accomplished with the harmonic scalpel, bipolar cutting device, stapling devices, suture ligature, or bipolar coagulation and laparoscopic scissors. Filshie clips have been used to obtain hemostasis at LSH.[11] Unfortunately, the studies in the current literature are difficult to combine because of the multiple techniques that are involved.

The most common technique that has been described in the US literature has been known as LSH or laparoscopic-assisted subtotal hysterectomy.[11-25] Most of these descriptions involve the placement of at least 3 and possibly 4 laparoscopic ports. The location and size of these ports varies by surgeon; however, most surgeons use a 5- or 10-mm umbilical port, one 5-mm and one 10- to 12-mm lateral port. The fourth port, if used, is usually placed in a suprapubic location. After entry and successful insufflation, the pelvis and abdomen are inspected, with special focus on the anatomy of the ureter, the presence or absence of disease, and the feasibility of the procedure. The utero-ovarian ligament, or the infundibulopelvic ligament if ovarian removal is desired, is divided with the use of the energy source of choice. The entire course of the ureter should always be known. The round ligament and remainder of the broad ligament are divided. It is important to remain several centimeters lateral to the uterus to avoid the uterine vasculature. The vesicouterine peritoneum is dissected off the anterior portion of the uterus, and the uterine arteries are skeletonized. At this point, the ascending branch of the uterine artery is identified, cauterized, and divided (Figure 1). The cervix is amputated from the corpus at a point just below the internal cervical os and superior to the uterosacral ligaments (Figure 2). The uterine corpus is placed in an easily accessible location until time for removal.

CISH is the second technique described for the performance of an LSH.[9,26-29] In this procedure, before

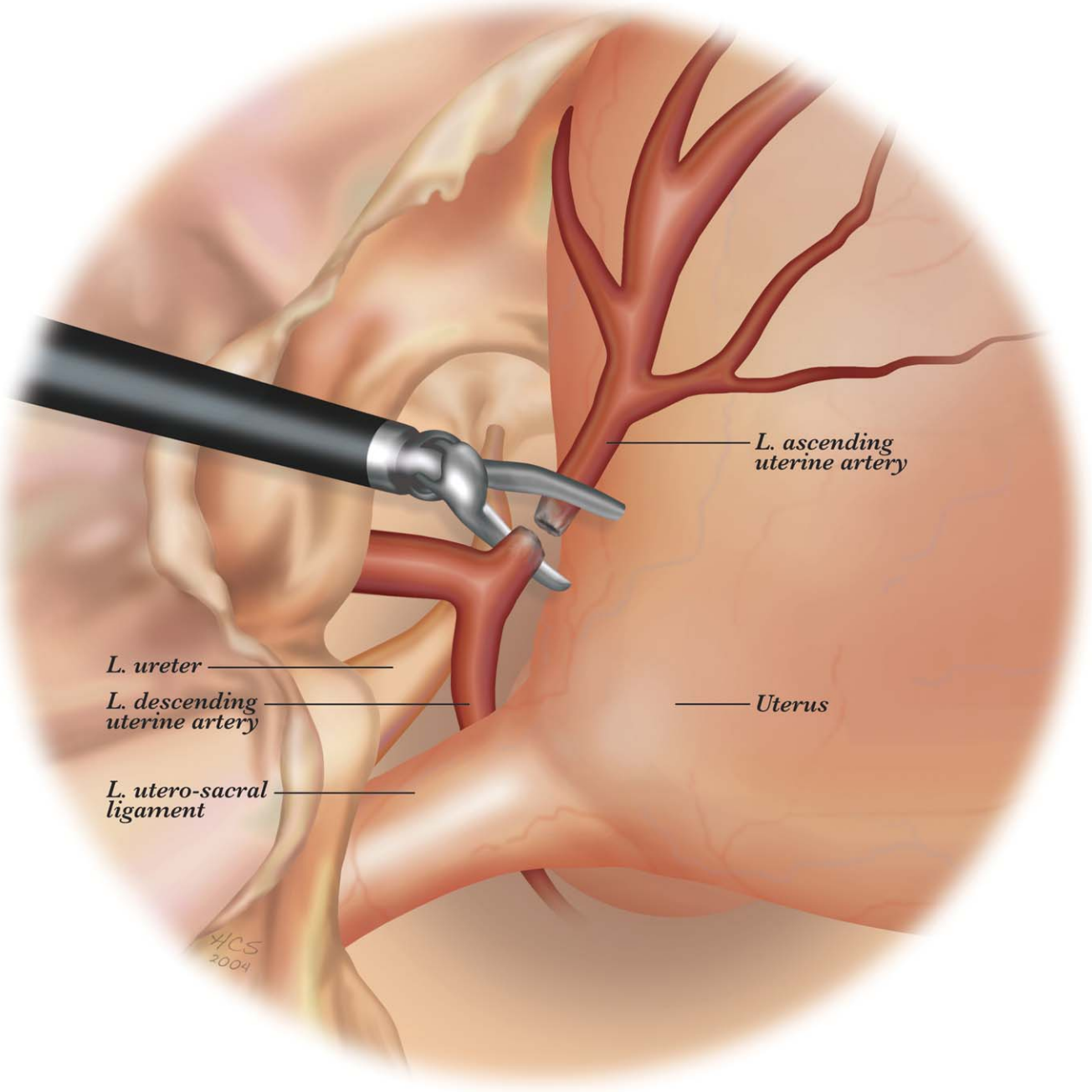

Figure 1 Laparoscopic view of the left, posterior surface of the uterus emphasizing the relationship of the uterine artery and the ureter. The ligation of the ascending branch of the uterine artery is depicted.

the amputation of the uterine corpus, a guide rod is passed from the vagina through the endocervical canal. The rod perforates the uterine fundus under laparoscopic visualization. Endoloops are placed around the cervix. At this point, an endocervical resecting device is placed on the guide wire, and the endocervical canal is removed entirely in a coring fashion (Figure 3). The endoloops are then tied to assist with hemostasis. The remainder of the procedure continues as previously outlined.

Published reports have varied in the handling of the remaining cervical stump and, more specifically, the treatment of the endocervical canal. Most authors recommend either ablation of the endocervical canal at the end of the procedure[7,11,16-18,24] or no treatment.[13-15,17,19,21,23] Reverse cervical conization has also been advocated.[12] As previously outlined, the CISH technique removes the entire endocervical canal. Currently, there is no definitive evidence that 1 method is clearly superior to another. The cervical stump may subsequently be

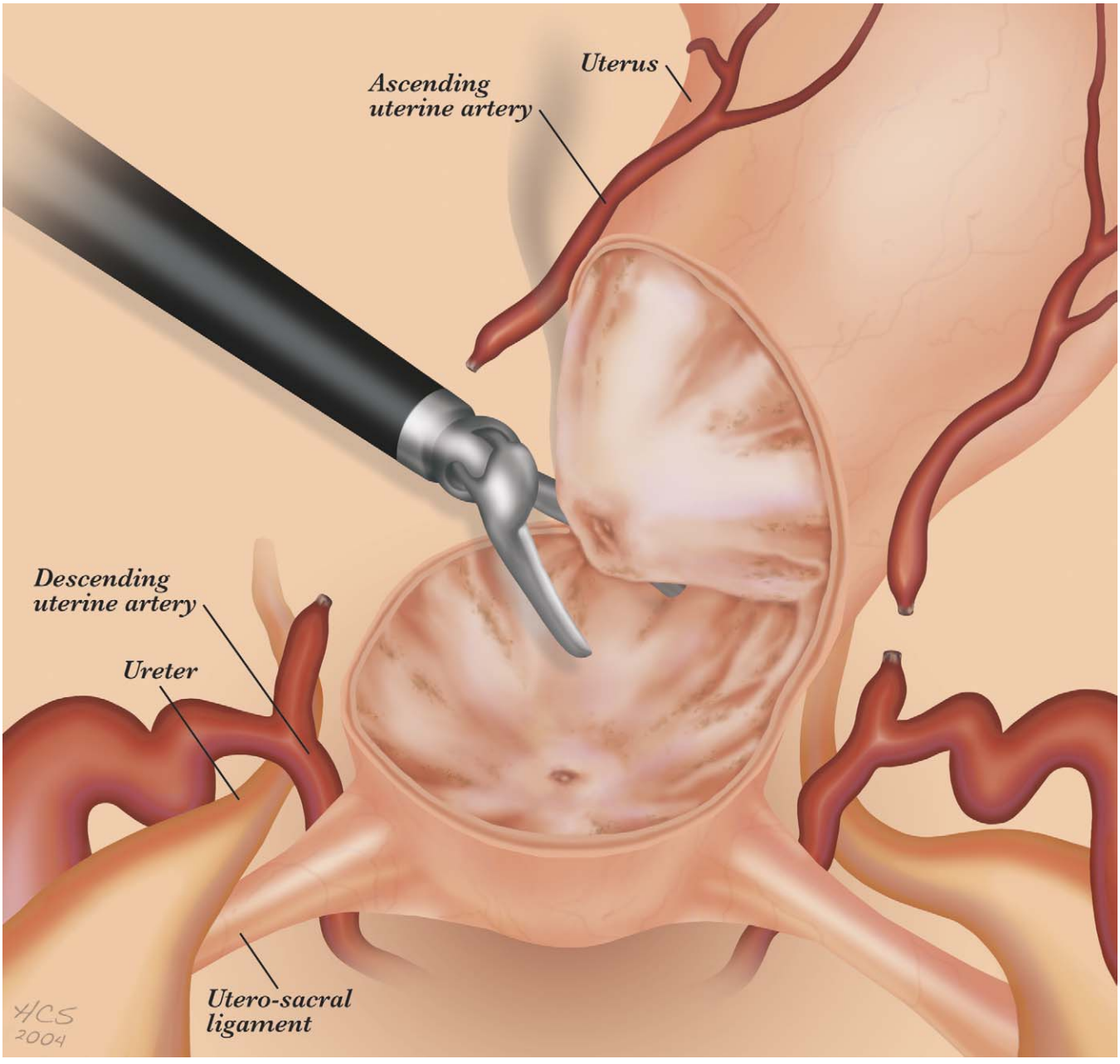

Figure 2 Laparoscopic view of amputation of the uterus and upper cervix. A scalloped approach is shown in order to limit the possibility of residual endometrium.

cauterized, imbricated, and/or covered with peritoneum or an adhesion barrier.

The initial case series described either manual morcellation and removal through the laparoscopic ports or posterior colpotomy for the removal of the uterine corpus; the latter technique has been abandoned. Since the publication of these case series, several manufacturers have developed laparoscopic morcellators that greatly improved the efficiency of uterine morcellation. Because the uterine corpus is removed in a piecemeal fashion, it is critical to ensure the complete removal of the uterine corpus and that the procedure not be performed without adequate preoperative endometrial assessment.

Examining the evidence

There are no randomized controlled trials that compare LSH to any other method of hysterectomy. In fact, our literature review identified only 1 randomized controlled trial involving LSH. Zupi et al[22] randomly assigned 181 patients to LSH and hysteroscopic endometrial resection (HER) and then followed these patients for 2 years postoperatively. LSH was compared with HER because

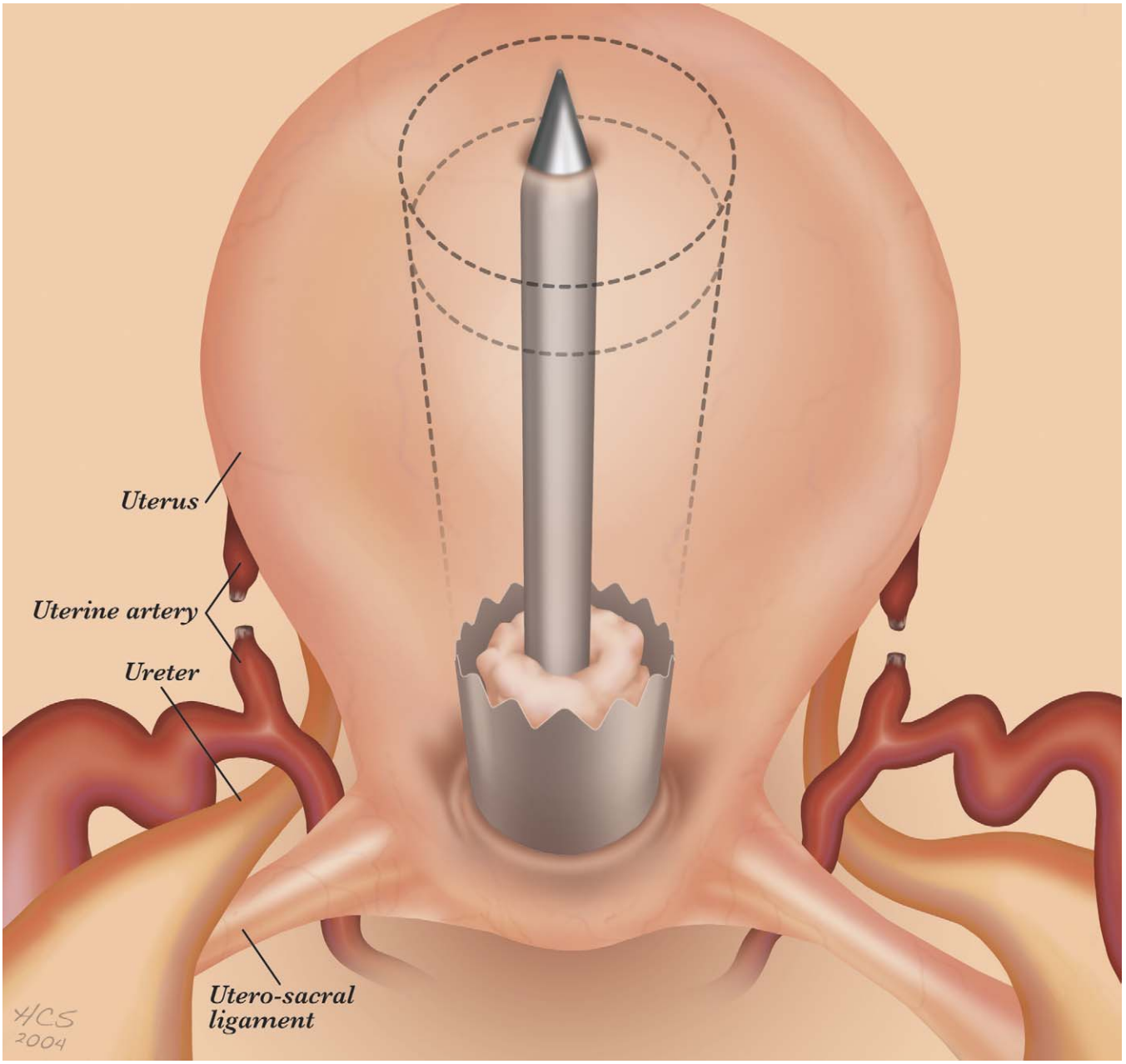

Figure 3 Laparoscopic view of the posterior uterus depicting the placement of the C.U.R.T. rod through the uterine fundus. The coring device is then used to remove the endocervical canal and endometrium during a C.I.S.H. procedure.

both procedures were indicated for the treatment of abnormal uterine bleeding and resulted in a retained cervix. The HER patients had significantly shorter operative times (41.7 vs 71.5 minutes; $P < .01$) and less immediate postoperative pain (3.8 vs 6.3; $P < .01$); however, HER patients had a significantly higher reoperation rate because of recurrent bleeding than did the LSH group (13.5% vs 1.1%; $P < .01$). When the reoperation costs were included, there was no statistically significant difference in the costs between HER and LSH. Furthermore, patient satisfaction at 2 years was significantly better for LSH patients than those who underwent HER.

LSH has been the subject of prospective cohort studies, retrospective case-control studies, and numerous case series (Tables I and II).[7,9,11-21,22-29] Most of the early reports compare LSH to LAVH in terms of operative time, complications, costs, and postoperative outcomes (Table III). All of these studies found that LSH resulted in a reduction in estimated blood loss and hospital stay, when compared with LAVH.[12,13,17,18,23] Most studies concluded that LSH had lower complication rates[12,18,23]

Table I LSH reports in the literature

Study	Study dates	Patients (n)	Mean operating room time (min)	Mean estimated blood loss (mL)	Total complications (n)	Vaginal bleeding (n)	Hospital stay (h)	Return to work (d)	Return to normal (d)
Lyons[12]	1990-1992	50	118	50	1 (2%)	N/A	18	7	3
Schwartz[13]	1991-1992	20	229	40	0	N/A	14	5.6	10.2
Donnez and Nisolle[14]	1991-1992	32	60	150	0	N/A	96	N/A	21
Schwartz[15]	1991-1992	40	N/A	N/A	11 (27%)	3 (7.5%)	N/A	N/A	N/A
Hasson et al[16]	1991-1993	34	212	114	10 (29%)	3 (8.8%)	<24	N/A	N/A
Richards and Simpkins[17]	1993-1994	20	127	179	8 (40%)	2 (10%)	36	N/A	N/A
Lalonde and Daniell[18]	1993-1994	20	106	200	2 (10%)	1 (5%)	26	N/A	N/A
Richards and Simpkins[19,*]	1993-1994	29	131	207	6 (21%)	2 (7%)	32	N/A	N/A
Van der Stege and van Beek[20]	1993-1996	41	N/A	N/A	6 (14.6%)	10 (25%)	N/A	N/A	N/A
Lyons[7,*]	1997	236	85	55	5 (2.1%)	3 (1.3%)	N/A	<3	14
Donnez et al[21,*]	1990-1996	500	62	<100	3 (0.6%)	6 (2.5%)	N/A	N/A	N/A
Zupi et al[22]	1995-1997	92	71.5	97	13 (14.1%)	N/A	40	3.5	10.3
Van Wijngaarden and Filshie[12]	1996-1998	12	N/A	210	2 (17%)	2 (17%)	72	6	18
Milad et al[23]	1997-1999	27	181	125	0	1 (3.7%)	24	N/A	N/A
Tietz[24]	1998-00	78	50	N/A	4 (5.1%)	N/A	48	N/A	N/A
Jugnet et al[25]	01	20	112	230	0	N/A	108	37	7

N/A, Not assessed.
* Report includes patients who were included in the previous study by the same author.

Table II CISH reports in the literature

Study	Study dates	Patients (n)	Mean operating room time (min)	Mean estimated blood loss (mL)	Total complications (n)	Vaginal bleeding (n)	Hospital stay (h)	Return to work (d)	Return to normal (d)
Ewen and Sutton[26]	1992-1993	11	111	185	3 (27.2%)	1 (9%)	72	N/A	20.1
Kim et al[27]	1993-1996	231	176	152	3 (1.3%)	23 (10%)	N/A	N/A	N/A
Simon et al[28]	1992-1996	138	N/A	N/A	8 (5.8%)	5 (3.6%)	20	N/A	N/A
Morrison and Jacobs[29]	1992-00	437	70	68	19 (4.3%)	4 (0.9%)	22	14	N/A
Okaro et al[9]	1992-1995	70	N/A	N/A	7 (10%)	8 (11.4%)	N/A	N/A	N/A

N/A, Not assessed.

and lower operating room time[12,18,23] and that the patients returned to work and/or normal activities at an earlier time, compared with LAVH patients.[12,13] Furthermore, both studies that addressed costs found LSH to be the less costly of the 2 procedures.[18,23]

All of these studies can be criticized on several grounds. First, most of these studies detail the results of a single surgeon who is an expert in operative laparoscopy; therefore, their results may not be applicable to the wider population of gynecologists. In deference to these authors, many of these reports represent their initial cases and give us an idea of "the learning curve" with this procedure. Second, although most of these series include a few large uteri, the average weight was usually between 100 and 250 g. This begs the question of whether all of these procedures could have been total vaginal hysterectomies instead of a laparoscopic variant. Third, selection bias is present because the patients were not randomly assigned to their particular surgery. Was the route of surgery chosen by the patient, the surgeon, or the

Table III Studies that compare LSH to LAVH

Study	Procedure	Patients (n)	Mean operating room time (min)	Mean estimated blood loss (mL)	Total complications (n)	Vaginal bleeding (n)	Hospital stay (h)	Return to work (d)	Return to normal (d)
Lyons[12]	LSH	50	118	50	1 (2%)	N/A	18	7	3
	LAVH	50	145	250	3 (6%)	N/A	37	22	14
Schwartz[13]	LSH	20	229	40	0	0	14	5.6	10.2
	LAVH	232	185	92	N/A	N/A	60	17	N/A
Richards and Simpkins[17]	LSH	20	127	179	8 (40%)	2 (10%)	36	N/A	N/A
	LAVH	21	117	210	2 (4%)	N/A	44	N/A	N/A
Lalonde and Daniell[18]	LSH	20	106	200	2 (10%)	1 (5%)	26	N/A	N/A
	LAVH	20	124	245	3 (15%)	N/A	34*	41	N/A
Milad et al[23]	LSH	27	181	125	0	1 (3.7%)	24	N/A	N/A
	LAVH	105	220*	400*	14 (13%)	N/A	48*	N/A	N/A

* Statistically significant difference at the level of $P < .05$.

patient's anatomy and disease? Fourth, most of the articles include only the complications that were related to the procedure itself and do not include information on long-term complications.

Weighing the pros and cons

Sexual function

Proponents of the subtotal approach describe improved sexual function as a benefit of supracervical hysterectomy. Previous work by Masters and Johnson has described the role of uterine contractions in orgasm, but they felt that the cervix was not involved in sexual function.[30] In 1983, Killku et al[31-33] published several articles regarding a prospective trial of 212 women who underwent either total hysterectomy or a supracervical hysterectomy. Twelve months after the operation, they identified no significant difference in coital frequency or libido between the 2 groups. However, dyspareunia, although improved in both arms, was significantly better in those women who underwent the supracervical procedure. Furthermore, women who underwent the supracervical approach had no change in their orgasmic frequency, although those women who total hysterectomy had a significant reduction in orgasmic coituses.[31,32] Hasson et al[16] suggested that this reduction in sexual arousal and orgasm is explained by the disruption or loss of the uterovaginal plexus of nerves during cervical resection. Most of the articles that were identified in our research referenced the Killku cohort when suggesting a sexual benefit to supracervical hysterectomy.[1,7,16-19,26,27] Very little research was done in this area until 2002 when Thakar et al[34] described a randomized controlled trial of 279 women who underwent either total abdominal hysterectomy (TAH) or supracervical hysterectomy. They found no difference between the procedures with regards to any sexual parameter.

Of the LSH trials that were identified in our research, none of the trials was designed to evaluate the effect of LSH on sexual function. Five of the authors, however, outlined their patients' sexual experience before and after the procedure.[11,18,20,25,35] Sexual experience was improved in most patients who experienced preoperative sexual problems; however, the patients felt that this was mainly due to less pain and bleeding. Those patients who described no preoperative sexual dysfunction were relatively unchanged after the procedure. Patients who underwent LSH did return to sexual function at an earlier time than other procedures; however the possibility of a counseling bias limits the significance of this finding.

Pelvic support

It has also been postulated that LSH prevents pelvic prolapse because of the preservation of the cardinal and uterosacral ligament complex. Although making practical sense, we could find no evidence to support this assertion. In fact, published reviews of cervicectomies have found that approximately 30% of all procedures were done as the result of cervical prolapse.[8,36] In 12 months of follow-up, Thakar et al[34] reported 2 cases of pelvic prolapse in the subtotal groups versus no cases in the total hysterectomy group. In light of this data, it seems that pre-existing pelvic floor damage from previous deliveries, chronic coughing, collagen damage may contribute to the pelvic prolapse as opposed to the method of hysterectomy.

Complications

Theoretically, LSH should result in fewer complications because the dissection ends superior to the bladder and ureter. Furthermore, infectious complications should be

reduced because the vagina is not entered. The current data, which is limited to level II and III data, confirm this assertion. The reported intraoperative complication rate varies widely from 0 to 40%[9,11-29]; however, the largest trials report rates of $\leq$2%.[7,21] Comparative complication rates for total vaginal hysterectomy, LAVH, and TAH are 5.3%, 3.6%, and 9.3%, respectively.[37] The intraoperative complications that are reported with LSH include hemorrhage, bladder perforation, fluid overload, and subcutaneous emphysema. No reports have detailed injury to the ureter or to the bowel; however, this fact is limited by the small number of reported patients and the potential for significant reporting bias. Postoperative complications have included cellulitis at the trocar sites, persistent vaginal bleeding, pelvic pain, delayed hemorrhage, persistent vaginal discharge, and positioning neuropathies.

In our review, the most important long-term complications were vaginal bleeding and pelvic pain. These morbidities were the most likely diagnoses to result in subsequent trachelectomy. Persistent vaginal bleeding has been reported to occur in 1.3% to 25%[9,11-29] of patients, with most series reporting a rate of 5% to 10% (Table I). In the largest case series, Donnez et al[21] and Lyons[7] describe vaginal bleeding rates of $<$2%. Because most of these patients reported only light bleeding, a trachelectomy was not required in all patients. The technique of handling the endocervical canal did not appear to make a significant difference in the rate of postoperative vaginal bleeding. Persistent postoperative pelvic pain was detailed in several reports. A follow-up study by Okaro et al[9] of 70 women who underwent CISH revealed that 13 women (18.6%) reported pelvic pain or dyspareunia at a mean follow-up period of 66 months. Furthermore, 17 of the 70 women (24.3%) underwent trachelectomy during the follow-up period. Interestingly, 14 women (82.3%) had been treated for endometriosis in the past, although only 30% of the women in the asymptomatic group had a history of endometriosis. Other authors have advised against LSH in the presence of endometriosis or pre-existing pelvic pain.[7,21]

Cervical cancer

Opponents of the supracervical approach consider it an incomplete procedure because it leaves a woman with a retained cervix and therefore the potential for the development of cervical dysplasia and cancer. In a screened population, the existing evidence does not support this assertion. It is important to emphasize that a supracervical hysterectomy is not appropriate for women with a significant history of cervical dysplasia or cancer or in noncompliant patients. In a screened population, the rate of cervical carcinoma is not different, whether the cervix is left in situ or removed. Killku and Gronroos[38] followed a prospective cohort of 2712 screened women who underwent supracervical hysterectomy between 1958 and 1978. They reported an incidence of cervical carcinoma of 0.11%. In a decision analysis regarding supracervical hysterectomy, Scott et al,[30] references a 10-year follow-up study which reported a 0.2% rate of cervical carcinoma in women with a cervical stump. These rates are not significantly different from the 0.17% incidence of vaginal cuff carcinoma after TAH.[39] As a result of this information, Thakar et al[34] stated that "the concern that cancer might develop in the cervical stump is no longer justification for routine use of total hysterectomy; screening reduces the incidence of invasive cervical cancer and the risk of cervical cancer after subtotal hysterectomy is $<$0.1%."

Cost-effectiveness

Laparoscopic procedures are often seen as expensive because of the cost of the instruments and the physician time that is required for education and surgical training. However, these costs can be minimized through the use of nondisposable instruments and through reduced operating room times as provider skill improves. As previously stated, the randomized controlled trial by Zupi et al[22] found no significant difference in the costs between hysteroscopic endometrial resection and LSH when the costs of reoperation were included. Simon et al,[28] in the only other trial that specifically reported costs, retrospectively compared 138 CISH procedures with 354 consecutive TAHs in a community hospital. As expected, operating room costs were more expensive for CISH, although hospital costs were higher for TAH because of longer hospital stay. The total costs were not significantly different between the 2 procedures. The authors point out that they did not account for the economic impact of an earlier return to work, function, and family, which is associated with CISH and LSH. Likewise, they did not assess the potential costs of reoperation for cervical removal if necessary.

Comment

LSH is a promising, minimally invasive technique for the treatment of uterine bleeding. It has significant potential advantages in terms of reducing surgical morbidity, both medically and socially. However, it has entered our surgical armamentarium before good scientific evidence has been obtained. Most of the emotional arguments for and against the procedure are based on little data. Multicenter, randomized controlled trials are needed to clarify the role of this procedure, but the appropriate comparison group remains controversial. Future research should include randomized controlled trials that compare LSH with total vaginal hysterectomy, TAH, and LAVH. These studies must

be designed to address the issues of complication rates, sexual function, urinary symptoms, pelvic support, and the potential for cervical dysplasia and carcinoma. Furthermore, the technique of LSH must be standardized to allow direct comparison.

Candidates for LSH should have a recent normal Papanicolaou test and no recent history of abnormal cervical cytologic condition. Candidates should also be compliant with annual health maintenance and should be committed to obtaining cervical cytologic evaluation at the recommended interval. There is some evidence that candidates should not have pre-existing pelvic pain or endometriosis, because of a high incidence of persistent pelvic pain. Current LSH data do not support the claims of improved sexual function and pelvic support, nor do they support an increased risk of cervical cancer in the appropriately selected patient. The evidence does support the assertion that the procedure results in a shorter hospital stay and a quicker return to normal activities, work, and sex. Patients must be informed that persistent vaginal bleeding and/or discharge are potential complications of the procedure. Furthermore, the potential for cervical dysplasia still exists; however, this can be treated with office-based procedures. Finally, in a small number of patients, trachelectomy may be necessary.

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