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Review article

Laparoscopic subtotal hysterectomy in the era of minimally invasive surgery

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ABSTRACT

According to a nation-wide population-based study in Taiwan, along with the expanding concepts and surgical techniques of minimally invasive surgery, laparoscopic supracervical/subtotal hysterectomy (LSH) has been blooming. Despite this, the role of LSH in the era of minimally invasive surgery remains uncertain. In this review, we tried to evaluate the perioperative and postoperative outcomes of LSH compared to other types of hysterectomy, including total abdominal hysterectomy (TAH), vaginal hysterectomy, laparoscopic-assisted vaginal hysterectomy, and total laparoscopic hysterectomy (TLH). From the literature, LSH has a better perioperative outcome than TAH, and comparable perioperative complications compared with laparoscopic-assisted vaginal hysterectomy. LSH had less bladder injury, vaginal cuff bleeding, hematoma, infection, and dehiscence requiring re-operation compared with TLH. Despite this, LSH has more postoperative cyclic menstrual bleeding and re-operations with extirpations of the cervical stump. LSH does, however, have a shorter recovery time than TAH due to the minimally invasive approach; and there is quicker resumption of coitus than TLH, due to cervical preservation and the avoidance of vaginal cuff dehiscence. LSH is therefore an alternative option when the removal of the cervix is not strictly necessary or desired. Nevertheless, the risk of further cervical malignancy, postoperative cyclic menstrual bleeding, and re-operations with extirpations of the cervical stump is a concern when discussing the advantages and disadvantages of LSH with patients.

Introduction

Subtotal or supracervical hysterectomy (STH) was a popular surgical procedure prior to the 1950s, but then it fell out of favor because of the advances in surgical techniques and the risk of cervical stump cancer.[1] Despite this, the procedure has made a comeback in the past two decades. According to a nation-wide population-based study by Wu et al[2] in Taiwan, the incidence of STH almost doubled from 2.8% in 1995 to 5.1% in 2005. Similarly, the ratio of STH to total abdominal hysterectomy (TAH) is increasing in the Western world, especially in Scandinavia.[1] This may be due to the evolving concept of minimal invasive therapy, organ preservation, and concerns about sexual dysfunction after TAH.[3,4] Effective cervical screening, as well as the introduction of diagnostic and therapeutic procedures, makes the concerns about subsequent precancerous and cancerous lesions of the cervical stump less of a concern.[5]

Although some clinical parameters and surgeons' expertise may influence the choice of hysterectomy approach,[6] minimally invasive surgery has become the standard of care for different procedures in gynecology.[3] Applications of single-incision laparoscopic surgery[7] and transvaginal natural orifice transluminal endoscopic surgery[8] are rapidly developing and may mark the new frontier in laparoscopy. Instrument improvements, such as the large vessel-sealing systems,[9] the Lap Loop system[9] together with electric morcellators, and increased acceptance by surgeons have improved feasibility and increased the uptake of laparoscopic supracervical/subtotal hysterectomy (LSH).[5] Despite the potential efficacy and safety of LSH, several debates remain, e.g., postoperative cyclic

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menstrual bleeding,[10,11] subsequent precancerous and cancerous lesions in the residual cervical stump,[12–14] and persistent symptoms with endometriosis.[11] As a result of these issues, the role of LSH currently remains uncertain.

In this review, we tried to evaluate the peri- and postoperative outcomes of LSH compared to other types of hysterectomy, including TAH, vaginal hysterectomy (VH), laparoscopic-assisted vaginal hysterectomy (LAVH), and total laparoscopic hysterectomy (TLH).

The surgical technique for LSH

Details of the surgical technique for LSH have been described previously.[15,16] Briefly, the video-laparoscopy is set up as usual, followed by the insertion of a uterine mobilizer into the cervical canal. Bipolar coagulation is used to desiccate and transect round ligaments and any ovarian ligaments (or infundibulopelvic ligaments). The anterior and posterior leaves of the broad ligament are divided several centimeters lateral to the uterus to avoid injury of the uterine vasculature. The ascending branches of the uterine arteries are skeletonized and transected. The uterine corpus is separated from the cervix at that isthmic level, which is between the internal cervical orifice and the utero-sacral ligaments. Then, the uterine corpus is morcellated and removed with the use of an electric morcellator. The ureters is identified by direct visualization. Various techniques have been described for LSH, e.g., dissection and hemostasis, handling of the endocervix, and removing the detached uterine corpus. The simplicity and safety of LSH comes from avoiding the dissection of the vesicouterine space, and preservation of the cardinal and uterosacral ligament complex.[15] It therefore offers a potentially safer surgical procedure associated with a lower morbidity and a quicker recovery time.[11,15,17–19]

The surgical techniques for LSH became easier, safer, and faster after the advancement of novel technologies, such as the larger vessel-sealing systems (e.g. tissue-sensing technology bipolar electrosurgery, and plasma kinetic PK[9]), the Lap Loop system[9] and electric morcellators, etc. These systems eliminate the need for the technically-demanding laparoscopic suturing and the need for frequent instrument in-and-out movements. Also, a better hemostasis minimizes intra- or postoperative hemorrhage.[20] The Lap Loop system allows safe, precise, and fast transection of the uterine body from the cervix.[9] It consists of a large loop that encompasses and cuts the uterine corpus, then retracts back into the introducer, regardless of the uterine size (Fig. 1). It reduces the risk of specimen slippage, vessel retraction, and damage to adjacent organs. Meanwhile, the electric morcellator has led to easier uterine removal, laparoscopically.

Source of data

A total of 10 most appropriate articles are presented here.[21–30] Several outcome parameters were reviewed, e.g., hospital stay, perioperative outcomes (including operation time, uterine weight, blood loss, or hemoglobin change, and the need for blood transfusion), intra- and postoperative complications, conversion rate, and postoperative outcomes (including recovery, quality of life, sexual function, urinary incontinence or prolapse of the pelvic organ, and bowel function).

The comparison of LSH with other approaches to hysterectomy

LSH versus TAH

LSH had a statistically shorter hospital stay, shorter operation time, and less blood loss and morbidity (especially febrile morbidity) than TAH (Table 1).[21] This may come from the fact that it is a minimally invasive surgery. Postoperative cyclic menstrual bleeding continued to be the only long-term complication for LSH.[21]

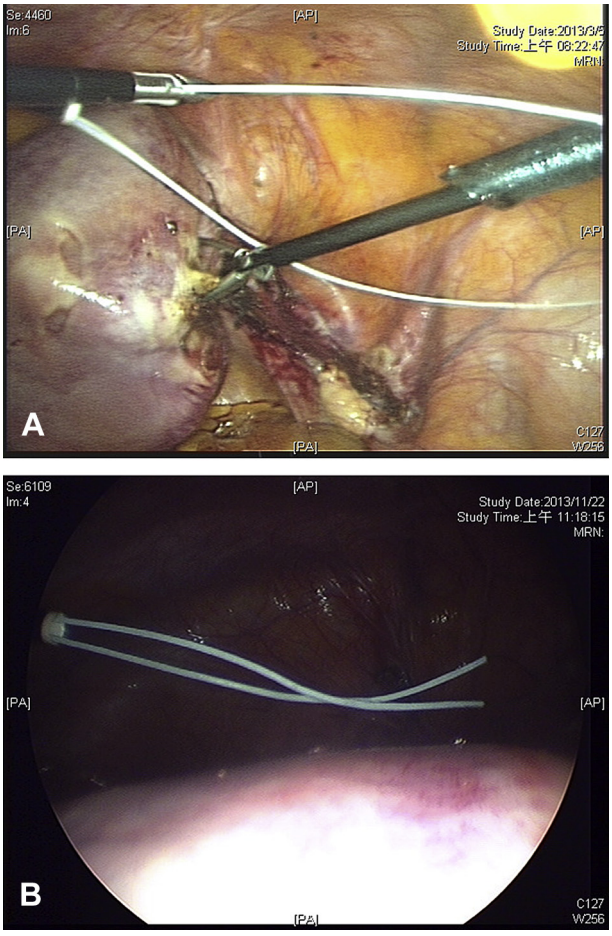

Figure 1. Use of the Lap Loop system for the uterus enlarged in size as 2 (A) and 4 (B) months of gestational age.

LSH versus VH: No available data

LSH versus LAVH

The blood loss and blood transfusion rates were similar between LSH and LAVH (Table 2).[22,23] The operation time seemed to be similar or shorter for LSH than for LAVH.[23] This may be due to the difference between a switch from laparoscopy to vaginal route in LAVH, and for morcellation in LSH.[23] The conversion rate, bladder injury, and febrile complications were similar for LSH and LAVH.[22,23] Jenkins,[15] however, reported a less morbidity, less blood loss, and shorter operation time and hospital stay for LSH. The incidence of postoperative cyclic menstrual bleeding for LSH was 3.7–10%.[15]

LSH versus TLH

The blood loss, blood transfusion, and febrile morbidity were similar for LSH and TLH (Table 3).[24,26,28] Boosz et al[24] reported a comparable operation time for LSH and TLH. The possible reason for this comes from the similar operation time for a morcellation in LSH and that for the suturing of the vaginal cuff and/or a switch from the laparoscopic to vaginal route in TLH.[24] Nevertheless,

Table 1
Comparative perioperative outcomes of laparoscopic supracervical/subtotal hysterectomy (LSH) versus total abdominal hysterectomy (TAH) according to Sarmini et al.[21]

Operative methods	*N*	Hospital stay (h)	Operation time (min)	Blood loss (mL)	Complications, *n* (%)
LSH	220	4.3 ± 0.7	47.7 ± 14.6	59.1 ± 17.5	0.9% conversion 4, laparoscopic-assisted vaginal hysterectomy 2, cyclic bleeding 11 (5%), extirpation of the cervical stump 1
TAH	220	80.1 ± 45.4	74.9 ± 25.6	275.3 ± 98.5	27.7% bladder injury 2 (0.9%), fever 32 (14.5%)

various operative techniques were used in LSH. The use of morcellation caused a larger incision and may lead to a greater requirement for postoperative analgesia after LSH.[28]

Most studies reported that the conversion rates were comparable for LSH and TLH, although it was debatable whether a conversion of laparoscopy to a laparotomy is a complication.[26] They were mostly related to technical difficulties, severe adhesions and uncontrolled bleeding.[26] There were also no significant difference between the complications for LSH and TLH, except a lower bladder injury for LSH.[26] There was more postoperative cyclic menstrual bleeding, and more re-operations for extirpations of the cervical stump for LSH; on the contrary, there were more cases of vaginal cuff bleeding, hematoma, infection, and dehiscence requiring re-operation for TLH (Table 3).[24]

Effects of LSH on recovery, quality of life, sexual function, urinary incontinence, pelvic organ prolapse, and bowel function

Few studies reported the related issues from our review. There was a lack of standardized outcome measurement system because the questions were in different formats. LSH seemed to have a slightly shorter recovery time and resumption of coitus (Table 4).[21,23,25,28–30]

The controversy about cervical preservation during open hysterectomy

The issues surrounding cervical preservation during hysterectomy have been debated for decades. STH results in fewer complications because the minor dissection is above the level of the bladder and ureter. STH also has fewer infectious complications because vaginal canal entrance is avoided. In the 2012 Cochrane review,[31] STH and TAH showed similar lengths of hospital stay, blood transfusion and re-admission rates; whereas STH had a shorter operation time, less blood loss and less febrile morbidity, but was more likely to result in postoperative cyclic menstrual bleeding. There were also no difference in short- and intermediate-term complications in STH and TAH (Table 5).

STH is empirically thought to result in better bladder, bowel, and sexual function because there is less disruption of the surrounding nerves. It is also been postulated that it prevents postoperative pelvic organ prolapse because it avoids destroying the ligaments that support the pelvis, such as the cardinal and uterosacral ligament complex. In the 2012 Cochrane review,[31] STH and TAH failed to show any difference in recovery, quality of life, sexual function, urinary incontinence, pelvic organ prolapse, constipation, or alleviation of pre-surgery symptoms (Table 5).

STH could be considered an incomplete procedure because it leaves a woman with a cervix and therefore with the potential risk of the development of cervical malignancy. It is important to emphasize that STH is not appropriate for women with a significant history of cervical dysplasia or cancer. Previous studies have reported an incidence of cervical carcinoma of 0.11–0.3% after STH.[12–14] This was comparable with the 0.17% incidence of vaginal cuff carcinoma after TAH.[32] Effective and routine cervical screening, however, makes concerns about subsequent precancerous and cancerous cervical stump lesions a minor issue.[5]

The advantages of cervical preservation during laparoscopic hysterectomy

Due to the lack of meta-analyses or randomized controlled trials available, the definitive benefits of LSH with cervical preservation during hysterectomy are not available. LSH has a better perioperative outcome compared with TAH, and is comparable with LAVH and TLH. LSH has lower bladder injury and vaginal cuff issues, such as bleeding, hematoma, infection, and dehiscence requiring re-operation, compared with TLH. This is understandable because there is less extensive separation of the bladder from the cervix during LSH. Ureter injury is however comparable, therefore the identification of the ureter during LSH is still necessary. In a prospective, randomized controlled trial by Morelli et al[33] with a 2-year follow-up study comparing complications and clinical outcomes, LSH and TLH had similar complication rates with the exception of higher re-admissions in LSH compared with TLH.

The most important long-term complications of LSH are postoperative cyclic menstrual bleeding and re-operations with extirpations of the cervical stump. Inadequate surgical technique with a

Table 2
Comparative perioperative outcomes of laparoscopic supracervical/subtotal hysterectomy (LSH) versus laparoscopic-assisted vaginal hysterectomy (LAVH).

Study	Operative methods	*N*	Hospital stay (h)	Uterine weight (g)	Operative time (min)	Blood loss/Hb change	Blood transfusion, *n* (%)	Complications, *n* (%)
Ghomi et al, 2011[22]	LSH	181	1.2 ± 0.5	121.5 ± 105.5	143.0 ± 51.7	2.2 ± 1.1 (g/dL)	1 (0.6)	26 (15%) conversion 8 (4.6%), bladder injury 3 (1.7%), fever 11 (6.3%)
	LAVH	265	1.6 ± 0.6	147.7 ± 84.8	145.1 ± 45.6	2.3 ± 1.1 (g/dL)	4 (1.6)	47 (19%) conversion 17 (6.9%), bladder injury 2 (0.8%), ureter injury 2 (0.8%), fever 15 (6.0%), re-operation 4 (1.6%)
El-Mowafi et al, 2004[23]	LSH	123	1–2	280 ± 6	120 ± 3	125 ± 5 (mL)	0	3 (2.4%)
	LAVH	136	1–2	235 ± 8	150 ± 5	149 ± 7 (mL)	0	5 (3.7%) conversion 2, bladder injury 1

Table 3
Comparative perioperative outcomes of laparoscopic supracervical/subtotal hysterectomy (LSH) versus total laparoscopic hysterectomy (TLH).

Study	Operative methods	*N*	Hospital stay (h or d)	Uterine weight (g)	Operative time (min)	Blood loss/Hb change (g/dL) or mL	Blood transfusion	Complications, *n* (%)
Boosz et al, 2011[24]	LSH	300	N/A	316.4 ± 245.1	103.4 ± 41.1	1.3 ± 0.8	2	4 (1.3%):[a] intraoperative 3 (1.0%); postoperative 1 (0.3%)
	TLH	567	N/A	242.7 ± 197.8	103.9 ± 43.9	1.5 ± 1.1	4	19 (3.4%):[b] intraoperative 7 (1.2%); postoperative 11 (1.9%); conversion 1 (0.2%)
Einarsson et al, 2011[29]	LSH	51	0.5 (d)	276	134.7 ± 46.6	50 (mL)	0	0 (0.0%)
	TLH	71	1 (d)	197	131.9 ± 42.4	50 (mL)	1 (1.4)	5 (7.0%):[c] intraoperative 1 (1.4%); postoperative 4 (5.6%)
van Evert 2010[25]	LSH	192	N/A	N/A	N/A	N/A	N/A	34 (17%):[d] short-term 7 (3.0%); long-term 27 (15.0%); conversion 9 (5.0%)
	TLH	198	N/A	N/A	N/A	N/A	N/A	30 (15.0%):[e] short-term 24 (12.0%); long-term 6 (3.0%)
Harmanli, 2009[26]	LSH	566	28.1 ± 14.8 (h)	190.3 ± 170	166.8 ± 62.5	1.86 ± 0.9	9 (1.6)	N/A[f] Conversion 23 (4.1%)
	TLH	450	32.9 ± 16.1 (h)	218.7 ± 196.2	168.1 ± 61.8	1.86 ± 0.9	8 (1.8)	N/A[g] Conversion 26 (5.8%)
Mousa 2009[28]	LSH	122	1.8 ± 0.2 (d)	181.0 ± 12.0	111.0 ± 2.9	129.6 ± 1.5–111.0 ± 1.7	5 (4.1)	21 (17.2%):[h] major 13 (10.7%); minor 8 (6.5%)
	TLH	105	1.5 ± 0.7 (d)	161.0 ± 11.6	136.0 ± 3.6	131 ± 1.3–110.0 ± 1.4	1 (1.0)	11 (10.5%):[i] major 4 (3.8%); minor 7 (6.7%); conversion 1 (1.0%)
Cipullo 2009[27]	LSH	158	N/A	162.7 ± 112.7	111.3 ± 30.0	2.0 ± 0.8	0	23 (14.6%):[j] major 2 (1.3%); minor 21 (13.3%)
	TLH	158	N/A	169.6 ± 116.5	121.7 ± 44.2	2.4 ± 0.8	1 (0.6)	29 (18.3%):[k] major 7 (4.4%); minor 22 (13.9%)

N/A = no available date.
[a] Bladder injury 1, ureter injury 1, extirpation of the cervical stump for cyclic bleeding 8 (2.7%), re-operation 11 (3.7%).
[b] Bladder injury 4, ureter injury 1, vaginal cuff dehiscence 4 (0.7%), vaginal cuff hematoma 5, re-operation 10 (1.8%).
[c] Vaginal cuff bleeding 2, infection 1.
[d] Fever 1 (0.5%), cyclic bleeding 12 (6%), extirpation of the cervical stump 4 (2%).
[e] Ureter injury 1 (0.5%), fever 2 (1%), vaginal cuff hematoma 9 (4.5%).
[f] Bladder injury 1, ureter injury 2, fever 5 (0.9%), vaginal wall perforation 1 (0.2%).
[g] Bladder injury 9, ureter injury 1, fever 6 (1.3%), vaginal cuff dehiscence 6 (1.3%).
[h] Bladder injury 2 (1.6%), fever 2 (1.6%), cyclic bleeding 1 (0.8%), re-operation 5 (4.1%).
[I] Bladder injury 1 (1.0%), ureter injury 1 (1.0%), fever 4 (3.8%).
[j] Fever 7 (4.4%).
[k] Bladder injury 2 (1.2%), ureter injury 1 (0.6%), fever 6 (3.7%), vaginal cuff bleeding 1, re-operation 2 (1.2%).

uterine amputation above the level of the internal cervical orifice may account for the high occurrence of postoperative cyclic menstrual bleeding following LSH.[11] Schmidt et al[34] reported that the routine excision of the endocervix was a quick and safe procedure leading to a significant reduction of postoperative cyclic menstrual bleeding (1.4% vs. 10.7%) during LSH. Paradoxically, few patients thought postoperative cyclic menstrual bleeding to be bothersome and requested further surgery. It did not therefore affect the overall satisfaction in patients with LSH.

In summary, LSH has a shorter recovery time than TAH, due to a minimally invasive approach and there is quicker resumption of coitus, compared with TLH, due to cervical preservation and therefore the avoidance of vaginal cuff dehiscence. No evidence relating to bladder or bowel function, and pelvic organ prolapse

Table 4
Comparative outcomes of laparoscopic supracervical/subtotal hysterectomy (LSH) versus total abdominal hysterectomy (TAH)/laparoscopic-assisted vaginal hysterectomy (LAVH)/total laparoscopic hysterectomy (TLH) on recovery, quality of life, sexual function, urinary incontinence, pelvic prolapse and bowel function.

Study	Operative methods	Authors' conclusions
Sarmini et al, 2005[21]	LSH vs. TAH	LSH had shorter intervals to return to daily activity (5.3 d vs. 19.5 d), return to full-time work (9.9 d vs. 58.1 d), and resumption of coitus (24.5 d vs. 59.0 d) compared with TAH
El-Mowafi et al, 2004[23]	LSH vs. LAVH	LSH had less sexual dysfunction during follow-up visits at 3 mo and 6 mo (0.8% vs. 21.3% and 0% vs. 19.3%) postoperatively, and a better sexual function 3 mo and 6 mo after surgery (89.5% vs. 75% and 87.2% vs. 75.4%) compared with LAVH
Einarsson et al, 2011[29]	LSH vs. TLH	LSH had a significantly higher postoperative improvement in quality of life scores, including physical functioning, physical role, and bodily pain; but no significantly difference in use of pain medications, level of pain, level of nausea, or return to normal activities compared with TLH
van Evert et al, 2010[25]	LSH vs. TLH	Urinary incontinence 2 (1%) vs. 2 (1%) Dyspareunia 4 (2%) vs. 0 (0%)
Mousa et al, 2009[28]	LSH vs. TLH	Urinary incontinence 3 (2.5%) vs. 0 (0%)
Kafy et al, 2009[30]	LSH vs. TLH	Both LSH and TLH improved general health and symptoms LSH and TLH had comparable quality of life parameters, including body and self-images, and sexual, gastrointestinal, and urinary functions

Table 5
Summary of the 2012 Cochrane review of open and laparoscopic methods.

	Open (subtotal hysterectomy versus total abdominal hysterectomy)	Laparoscopic (laparoscopic supracervical/ subtotal hysterectomy versus laparoscopic hysterectomy)
Perioperative outcomes		
Hospital stay	Similar	N/A
Operative time	Shorter	Similar
Blood loss	Less	Similar
Blood transfusion	Similar	Similar
Complications		
Febrile and urinary retention	Less	N/A
Cyclic bleeding	More likely	N/A
Readmission rate	Similar	Similar
Short-term complications[a]	No evidence of difference	N/A
Intermediate-term complications[b]	No evidence of difference	N/A
Postoperative outcomes		
Recovery	No evidence of difference	N/A
Quality of life	No evidence of difference	N/A
Sexual function	No evidence of differences in satisfaction or dyspareunia	N/A
Urinary incontinence	No evidence of differences in stress incontinence, incomplete emptying or urinary urgency	N/A
Pelvic prolapse	No evidence of difference	N/A
Constipation	No evidence of differences in constipation or incontinence of stools	N/A
Alleviation of pre-surgery symptoms	No evidence of difference	N/A

N/A = no available data.
[a] Surgical injury, pelvic hematoma, vaginal bleeding, wound infection, or bowel obstruction.
[b] Persistent pain after discharge, removal of the cervical stump, pelvic prolapse, or gynecological cancer.

was found comparing with TAH, LAVH, and TLH. Rare studies reported these issues and more studies are needed.

Conclusion

LSH is a safe and effective treatment for menorrhagia and other menstrual disorders when hysterectomy is indicated.[19] According to the literature, LSH is an alternative option when removal of the cervix is not strictly necessary or desired. The risks of further cervical malignancy, postoperative cyclic menstrual bleeding and re-operations with extirpations of the cervical stump are, however, concerns when informing patients about the advantages and disadvantages of LSH.

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