Systematic Review

Vaginal Hysterectomy Compared With Laparoscopic Hysterectomy in Benign Gynecologic Conditions

A Systematic Review and Meta-analysis

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OBJECTIVE: To compare surgical efficacy outcomes and complications after laparoscopic hysterectomy and vaginal hysterectomy performed for benign gynecologic conditions.

DATA SOURCES: We performed an online search in major databases, including PubMed, Scopus, Web of Science, ClinicalTrials.gov, and the Cochrane Library from 2000 until February 28, 2023.

METHODS OF STUDY SELECTION: We searched for randomized controlled trials (RCTs) that compared vaginal hysterectomy with laparoscopic hysterectomy in benign gynecologic conditions. We located 3,249 articles. After reviewing titles and abstracts, we identified 32 articles that were eligible for full-text screening. We excluded nine articles as not-RCT or not comparing vaginal hysterectomy with laparoscopic hysterectomy. Twenty-three articles were included in the final systematic review, with 22 articles included in the meta-analysis.

TABULATION, INTEGRATION, AND RESULTS: Twenty-three eligible RCTs included a total population of 2,408, with 1,105 in the vaginal hysterectomy group and 1,303 in the laparoscopic hysterectomy group. Blood loss and postoperative urinary tract infection rates were lower in the vaginal hysterectomy group than in the laparoscopic hysterectomy group (mean difference −68, 95% CI −104.29 to −31.7, $P<.01$, $I^2=95\%$ and odds ratio 1.73, 95% CI 0.92–3.26, $P=.03$, $I^2=0\%$, respectively). Vaginal hysterectomy was associated with less total operative time, less recovery time, and greater postoperative pain on the day of surgery. Other complications, including conversion to laparotomy, visceral organ damage, or wound dehiscence, were uncommon. Because of insufficient data, we were not able to stratify by surgical indication.

CONCLUSION: Vaginal hysterectomy had a shorter total operative time and recovery time but greater postoperative pain on day of surgery compared with laparoscopic hysterectomy.

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Hysterectomy is the most common major gynecologic surgical procedure, with about 70% of hysterectomies performed for benign conditions such as leiomyoma, endometriosis, and uterine prolapse.[1] Several minimally invasive techniques have been described and used, leading to interest in which techniques may be superior.

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The Marchand Institute remains committed to diversity and tolerance in its research and actively maintains a workplace free of racism and sexism. More than half of the authors for this study are female, and many represent diverse backgrounds and underrepresented ethnic groups.

Each author has confirmed compliance with the journal's requirements for authorship.

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Vaginal, abdominal, laparoscopic, and robotic-assisted laparoscopic hysterectomies are common hysterectomy approaches. Vaginal hysterectomy has benefits over abdominal hysterectomy, including faster recovery, lower incidence of postoperative fever, and a shorter hospital stay.[2] In general, recommendations include that abdominal hysterectomy should be limited to clinical scenarios,[3] with vaginal hysterectomy being the preferred surgical procedure for benign conditions when it is clinically and technically possible.[4,5]

A growing number of hysterectomies are currently performed with laparoscopic or laparoscopic and robotic assistance.[6] Among the most common are the laparoscopically assisted vaginal hysterectomy (LAVH) and total laparoscopic hysterectomy.[7] For the remainder of this article, laparoscopic hysterectomy includes both total laparoscopic hysterectomy and LAVH procedures. Although laparoscopic hysterectomy may not always be feasible because of body habitus, adhesive disease, or malignant conditions, it does provide a minimally invasive approach to hysterectomy with some potential advantages.[8–10] Some gynecologists prefer performing laparoscopic hysterectomy because of the potential improved anatomic view; an increased ability to treat adhesive disease, large uteri, and uteri with no descent[11]; or surgeon preference.

Whether laparoscopic hysterectomy or vaginal hysterectomy is superior in treating benign disease continues to be debated among gynecologic surgeons, with inconsistent results in published randomized controlled trials (RCTs).[11–13] Therefore, we compared surgical outcomes and complications between laparoscopic hysterectomy and vaginal hysterectomy in women undergoing hysterectomy for benign gynecologic conditions in this systematic review and meta-analysis.

SOURCES

We applied the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement[14] recommendations in preparation of this review. The selection of included studies was guided by the following eligibility criteria: 1) RCTs, 2) women with benign gynecologic conditions, and 3) vaginal hysterectomy compared with laparoscopic hysterectomy or its subtypes. We applied no language restrictions. We excluded non-RCTs or studies that included patients undergoing hysterectomies for malignant conditions.

We searched PubMed, Scopus, Web of Science, and Cochrane Library from January 2000 to February 2023 for eligible studies. We applied the following combined key words: "vaginal hysterectomy" and "laparoscopic hysterectomy" or "laparoscopic assisted vaginal hysterectomy" or "laparoscopically-assisted vaginal hysterectomy." We also searched in ClinicalTrials.gov for matching RCT's, but because this search engine does not index published articles, we did not include this on our flowchart, which is shown in Figure 1. All identified and eligible studies found on ClinicalTrials.Gov were also found as full published articles. In Appendix 1, available online at http://links.lww.com/AOG/D463, comprehensive search strategies for each of the searched databases are detailed. We searched relevant reviews and references of included studies for articles that met our inclusion criteria.

STUDY SELECTION

The collected studies were independently reviewed for eligibility. First, titles and abstracts were screened with Rayyan software.[15] The final studies to be included in the meta-analysis were chosen by performing a full-text screening of the eligible research articles. Studies comparing the efficacy or safety of vaginal hysterectomy and laparoscopic hysterectomy were included. Primary efficacy outcomes were operation time, blood loss, and length of hospital stay. Secondary end points comprised intraoperative visceral injuries, need for transfusion, fever, need for laparotomy, bleeding, and pelvic hematoma formation. We performed a descriptive analysis for tertiary outcomes reported by fewer than four studies.

We extracted study and patient characteristics and relevant outcomes using Microsoft Excel in two separate sheets. Study characteristics included study design, country, number of participants, main inclusion and exclusion criteria, outcomes, and surgical method. Patient characteristics included age, body mass index (BMI, calculated as weight in kilograms divided by height in meters squared), parity, and uterine weight. Surgery complications, operative time, length of hospital stay, and other relevant outcomes were all extracted. The methods outlined by Hozo et al[16] were used to transform the data when data sets contained only the median and range rather than all raw statistics. Five studies required this conversion.[17–21]

We used Cochrane's risk of bias tool[22] for evaluating the methodologic quality of included studies. We evaluated studies using the following domains: generation of a random sequence, allocation concealment, participant and personnel blinding, blinding in assessment of outcome, inadequate outcome data,

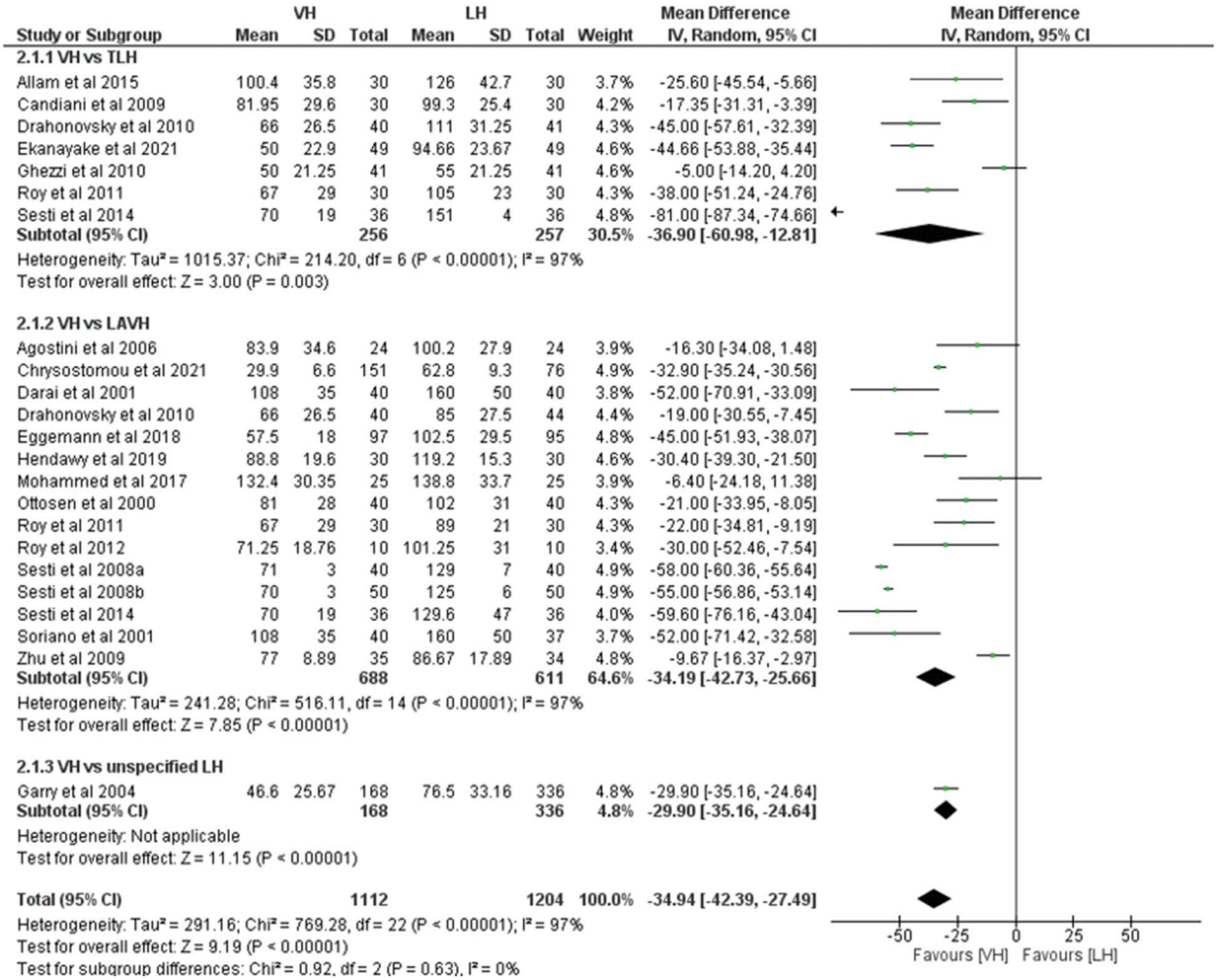

Fig. 1. Meta-analysis of operative time. VH, vaginal hysterectomy; LH, laparoscopic hysterectomy; IV, independent variable; TLH, total laparoscopic hysterectomy; df, degrees of freedom; LAVH, laparoscopic-assisted vaginal hysterectomy.
Azadi. Vaginal vs Laparoscopic Hysterectomy in Benign Gynecologic Conditions. Obstet Gynecol 2023.

selective reporting, and other sources of bias. Each item was judged as low risk, some concerns, or high risk of bias. In addition, we assessed the methodologic quality of evidence using the GRADEpro software (Appendix 2, available online at http://links.lww.com/AOG/D463). We used Review Manager 5.4 to perform the meta-analysis. We used odds ratios (ORs) with a 95% CIs to compare dichotomous outcomes and mean difference with 95% CI for continuous outcomes; $P<.05$ was considered significant. I^2 values were used to determine the degree of heterogeneity, categorized as low heterogeneity if the I^2 value was less than 25%, moderately heterogeneity if I^2 was 25–75%, and high heterogeneity if I^2 was higher than 75%. In the meta-analysis, a fixed-effect model was initially used, assuming homogeneity between included studies. If moderate heterogeneity was present, the random-effects model was applied. We subgrouped studies comparing vaginal hysterectomy and laparoscopic hysterectomy as follows: vaginal hysterectomy versus LAVH, vaginal hysterectomy compared with total laparoscopic hysterectomy, and vaginal hysterectomy compared with unspecified laparoscopic hysterectomy. Because of this, the number of patients undergoing vaginal hysterectomy was duplicated in some calculations comparing total laparoscopic hysterectomy and LAVH with the same vaginal hysterectomy group.

RESULTS

The primary literature search yielded 3,249 records. After reviewing titles and abstracts, we identified 32 articles that were eligible for full-text screening. We excluded nine articles as not-RCTs or not comparing

vaginal hysterectomy with laparoscopic hysterectomy. Twenty-three articles were included in the systematic review, with 22 included in the meta-analysis (Appendix 3, available online at http://links.lww.com/AOG/D463).

The total eligible population was 2,408, with 1,105 in the vaginal hysterectomy group and 1,303 in the laparoscopic hysterectomy group. Studies were conducted in Italy,[11,12,23–26] France,[27–29] India,[17,18] Egypt,[30–32] South Africa,[33,34] Brazil,[35] Sweden,[19] Sri Lanka,[20,36] China,[37] and Czech Republic.[13] Two studies[30,34] specified their inclusion for uterine size less than 12 weeks of gestation or less than 280 g, and six studies limited their inclusion for uterine size equal or larger than 12 weeks or more than 280 g.[23–25,27,28,32] Age was reported in all studies except one[35] and ranged between 43–55 and 40.9–54.67 years in the vaginal hysterectomy group and laparoscopic hysterectomy group, respectively. Fourteen studies[17,18,20,23–26,28,29,31,34,37–39] reported uterine weight that ranged between 91.5 and 424 g in the vaginal hysterectomy group and 88.4 and 481 g in the laparoscopic hysterectomy group. All studies except four[27,28,35,37] reported BMI, and only 15 studies reported parity.[13,17,18,20,23–25,27–32,34,36] There were insufficient data to categorize subgroups by surgical indication. Tables 1 and 2 include detailed characteristics of the studies and participants included.

A summary of the risk of bias among studies is illustrated in Appendix 4, available online at http://links.lww.com/AOG/D463. Regarding selection bias, five studies[17,18,30,35,37] were judged as unclear for reporting insufficient data about generation of a random sequence, and the rest were considered low risk. Regarding allocation concealment, two studies[20,37] were judged to be high risk, 11 were low risk,[11,19,21,23,25,31–34,38,40] and the rest were unclear. For participant, personnel, and assessment of outcome blinding, two studies[23,25] were unclear regarding risk of bias, and the remaining studies were found to have a high risk of bias in these three domains. Four studies[11,17,18,33] reported incomplete data and thus introduced the possibility of a high risk of bias, and one study[37] was judged as unclear. Eight studies[12,18,21,27,28,35,37,40] were associated with unclear risk of bias in the selective reporting domain, and the remaining studies were judged to be low risk. The one exception was the study by Zhu et al,[37] which was judged to be high risk. Four other studies[18,21,33,40] were judged to be unclear, and risk in the "other bias" domain was found to be low in all studies.

Twenty studies[11–13,17–20,23–25,27,28,30–34,37,38,40] provided data on operative time for quantitative analysis. Pooled analysis concluded that vaginal hysterectomy takes 34.94 minutes less than laparoscopic hysterectomy (95% CI −42.39 to −27.49). We used a random-effects model because of high heterogeneity (I^2=97%) (Fig. 1).

Pooled analysis of data available from 20 studies[11–13,17–21,23–25,27,28,30–32,34,37,38,40] indicated that vaginal hysterectomy was associated with a 0.17-day decrease in length of hospital stay compared with laparoscopic hysterectomy. However, this did not reach statistical significance (95% CI −0.43 to 0.09). The data were also associated with high heterogeneity (I^2=96%) (Fig. 2).

Blood loss was significantly lower in the vaginal hysterectomy group (mean difference −68, 95% C: −104.29 to −31.7, I^2=95%) (Fig. 3). Urinary tract injury was uncommon and was calculated by combining bladder and ureteric injuries. Urinary tract injury occurred in 1.8% of vaginal hysterectomies (14/760) and 1.4% of laparoscopic hysterectomies (12/856) (OR 1.22, 95% CI 0.6–2.46, I^2=0%), and these events were rare (Appendix 5, available online at http://links.lww.com/AOG/D463). Other visceral injuries such as bowel, rectal, and vascular injury were even less common.

On pooled analyses, for *intraoperative hemorrhage* (defined as blood loss greater than 500 mL), vaginal hysterectomy had a rate of 3.5% (17/491) and laparoscopic hysterectomy had a rate of 4.9% (32/657) (OR 0.71, 95% CI 0.39–1.29, I^2=0%) (Appendix 6, available online at http://links.lww.com/AOG/D463). The rates for conversion to laparotomy were 2.8% for vaginal hysterectomy and 4.1% for laparoscopic hysterectomy (OR 0.69, 95% CI 0.39–1.28, I^2=11%) (Appendix 7, available online at http://links.lww.com/AOG/D463); 7.8% in the vaginal hysterectomy group (52/664) and 5.4% in laparoscopic hysterectomy group had postoperative fever (OR 1.48, 95% CI 0.98–2.23, I^2=0%) (Appendix 8, available online at http://links.lww.com/AOG/D463). In the vaginal hysterectomy group, 4.5% had a blood transfusion compared with 5.2% in the laparoscopic hysterectomy group (OR 0.84, 95% CI 0.51–1.37, I^2=0%) (Appendix 9, available online at http://links.lww.com/AOG/D463).

Data from five studies[17–21] about *recovery time* (defined as the return to normal life activities) were pooled. Using a random-effects model because of heterogeneity (I^2=30%), our meta-analysis indicated that vaginal hysterectomy was associated with 2.45 days less recovery time (95% CI −4.7 to −0.2, P=.03). This result was unchanged whether a fixed or random model was used (Appendix 10, available online at http://links.lww.com/AOG/D463).

Table 1. Summary of the Included Studies

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
Agostini et al[40]	RCT	France	48	Inclusion criteria were as follows: hysterectomy indicated for benign uterine lesion (fibroma, adenomyosis, endometrial hyperplasia), upper edge of the uterus at or below the midpoint of the pubis and the umbilicus by palpation, age more than 45 y, and patient's informed decision in favor of bilateral oophorectomy	Exclusion criteria were as follows: contraindication to pneumoperitoneum (pulmonary or cardiac insufficiency), adnexal anomaly diagnosed at ultrasonogram (anechoic ovarian cyst larger than 20 mm, echogenic ovarian cyst, hydrosalpinx), refusal of oophorectomy, refusal of vaginal procedure, and virgin patient	Surgical characteristics (duration of procedure, blood loss, uterine weight) and postoperative period (duration of hospitalization). The complications analyzed were as follows: intraoperative bleeding (collected by suction) greater than 500 mL, blood transfusion, hematoma or bleeding of trocar ports requiring prolongation of care or surgical treatment, hematoma or bleeding of the vaginal cuff requiring prolongation of care or surgical treatment, or postoperative fever greater than 38°C for more than 24 h.	VHO, LAVHO
Allam et al[31]	RCT	Egypt	60	Patients who were admitted from the gynecologic outpatient clinic to undergo hysterectomy were enrolled	Malignant uterine pathology and contraindication for TLH (eg, severe cardiac disease) were the exclusion criteria	Main outcome measures: 1) *Operative time* was defined as the time spent from start of operation until the closure with satisfactory hemostasis. 2) Operative blood loss was estimated from the number of gauze towels used and the amount of blood in the suction bottle after	VH, TLH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						subtracting the amount of the washes in case of LH. 3) Postoperative hemoglobin and hematocrit were measured 24 h after the end of the procedure. 4) Operative complications, including blood transfusion, laparotomy in cases of VH or TLH, or relaparotomy in AH group, bowel and urinary tract injury, and wound infection. 5) Postoperative pain was assessed with the VAS (from 0 to 10) and the need for analgesics. 6) Postoperative hospital stay duration. 7) Follow-up: the patients were followed up after 1 and 6 wk for any further complications.	
Candiani et al[11]	RCT	Italy	60	Patients referred to the Department of Gynecology and Obstetrics at San Paolo Hospital, University School of Medicine (Milan, Italy), with an indication for vaginal hysterectomy for benign pathology	Exclusion criteria were a uterine volume greater than 300 mL, previous surgery for pelvic inflammatory disease or endometriosis, suspicion of malignancy, presence of an ovarian cyst greater than 4 cm, and vaginal prolapse higher than 1st degree	The primary end point of the trial was the hospital stay. We always used the same parameters to discharge patients: restarted bowel motility, regular abdomen and vaginal objectivity, absence of temperature (greater than 37° C), lack of urinary problems, and patient comfort. The secondary	VH, LH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						goals included pain, measured by a VAS, analgesic requests, blood loss, and execution of adnexectomy if preoperatively planned.	
Chrysostomou et al[34]	RCT	South Africa	227	Women admitted for hysterectomy for benign uterine conditions meeting the inclusion criteria set by the unit (ie, vaginally accessible uterus, uterine size equivalent to less than 12 wk of gestation or less than 280 g on ultrasound examination and pathology confined to the uterus) were included in the study	Patients with uterine prolapse were excluded	Outcome variables among those who underwent VH and LAVH were recorded and analyzed, including length of postoperative hospital stay, intraoperative and immediate postoperative complications (bladder perforations, conversion to AH, and need for second-look laparotomies), and postoperative pain (need for analgesia). The costing was done from the health care professional's perspective (the hospital) and focused on direct costs. Indirect costs included costs for laboratory investigations, medications not related to the procedure, drugs used after the operation for either analgesia or pain control, and management of complications if any.	VH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
Darai et al[27]	RCT	France	80	Inclusion criteria were traditional contraindications for vaginal hysterectomy, including uterine size larger than 280 g and one or more of the following: previous pelvic surgery, history of pelvic inflammatory disease, moderate or severe endometriosis, concomitant adnexal masses, or indication for adnexectomy	Exclusion criteria included anesthetic contraindications for laparoscopic surgery and suspicious adnexal mass based on ultrasonographic examination, ovarian blood flow, and tumor markers. We also excluded women with vaginas narrower than two-finger wide and immobile uteri with no descent and no lateral mobilization	Duration of the operation, hemoglobin level, and postoperative complications were among the outcomes.	VH, LAVH
Drahonovsky et al[13]	RCT	Czech Republic	125	Women scheduled to undergo a hysterectomy for benign disease were enrolled in the study	Patients were excluded from this study if they had contraindications to either vaginal hysterectomy, such as several prior abdominal surgeries or severe endometriosis, or to laparoscopy, including underlying medical conditions that could be worsened by pneumoperitoneum or the Trendelenburg position. In addition, patients were excluded if they had a suspected or confirmed malignant disease, with the exception of CIN 3, or a uterine size greater than 120×80×80 mm on preoperative ultrasound examination. Urinary incontinence, uterine descent or	Intra and postoperative evaluations included the duration of anesthesia, length of operation (from first incision to last suture), uterine weight, frequency of intraoperative complications, conversion rate, and estimated blood loss. Blood loss was assessed by two different methods, intraoperative measurement of blood loss and the difference between hemoglobin levels before surgery and on 1 and 3 d after surgery.	VH, TLH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
					vaginal prolapse greater than the 1st degree, or the necessity of another concomitant surgical procedure also constituted exclusion from this study		
Eggemann et al[38]	RCT	Germany	192	Patients were eligible to participate if they were diagnosed with a benign gynecologic disease and performance of vaginal hysterectomy was possible	Exclusion criteria were incomplete written informed consent, descensus genitals with indication for sacral colpopexy or lateral repair, genital malignancy, contraindications for laparoscopy, opioid treatment in the last 12 mo longer than 2 wk, allergy against methimazole and piritramide, adverse psychiatric and neurologic diseases, addiction to drugs and alcohol, polyneuropathy, and immunosuppressive therapy	The primary outcome of the trial was the comparison of postoperative pain in four different groups depending on surgical type of hysterectomy or of performance of PC. Second outcome measures were postoperative activity and mobility, operating time, blood loss, intraoperative and postoperative complications, additional findings intraoperatively, and hospital stay.	VH, LAVH
Ekanayake et al[36]	RCT	Sri Lanka	98	Eligible participants were patients requiring hysterectomy for nonmalignant uterine causes	Exclusion criteria were uterus larger than 14 wk, previous pelvic surgery, those requiring incontinence surgery or pelvic floor surgery, and any medical illness that caution or contraindicate laparoscopic surgery	Urinary and sexual function were assessed by the validated Sinhala and Tamil translations of ICIQ-FLUTS and ICIQ-VS, which were obtained from the International Consultation on Incontinence. Bowel symptoms were assessed using a questionnaire based on a study done by Thakar et al.[44] These questionnaires were used preoperatively and 6 mo and up	NDVH, TLH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						to 1 y after the hysterectomy to detect changes in pelvic organ function.	
Ekanayake et al[20]	RCT	Sri Lanka	98	Eligible participants required hysterectomy for benign uterine causes	Exclusion criteria were uterus larger than 14 wk, previous pelvic surgery, any illness that contraindicated laparoscopy, and any patient requiring surgery for incontinence or uterovaginal prolapse	The primary outcome measure was time to recover after hysterectomy, which was considered the earliest time to resume activities done before surgery (eg, cooking, washing clothes, occupation, and sexual activity). Other outcome measures were operative time, blood loss, pain scores, complications, postoperative hospital stay, direct cost, and cost effectiveness.	NDVH, TLH
Garry et al[33]	RCT	South Africa	504	Patients who needed a hysterectomy for nonmalignant conditions were eligible	Excluded were patients who had a 2nd- or 3rd-degree uterine prolapse, a uterine mass greater than the size of a 12-wk pregnancy, a medical illness precluding laparoscopic surgery, or a requirement for bladder or other pelvic support surgery, as well as patients who refused consent	The primary end point of the trials was the occurrence of at least one major complication. Major hemorrhage was regarded as a major complication if a blood transfusion was required, minor otherwise; hematoma was a major complication if surgical drainage was required, minor otherwise. An independent clinical reviewer differentiated between major	VH, LH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						and minor anesthetic problems. Secondary end points were minor complications, blood loss, pain measured by a VAS and analgesia requirements, and questionnaire assessments of sexual activity, body image, and health status (SF-12).	
Ghezzi et al[12]	RCT	Italy	82	Consecutive patients referred to the Department of Gynecology and Obstetrics of the University of Insubria with an indication for hysterectomy for a supposed benign gynecologic condition were asked to participate in the current study	Exclusion criteria was as follows: uterine volume 14 wk of gestation at clinical evaluation, suspicion of malignancy, concomitant presence of large adnexal masses (maximum diameter greater than 4 cm at preoperative ultrasonography), and pelvic organ prolapse greater than stage 1 according to POP-Q classification	Operative time, estimated blood loss, uterus weight, concomitant monobilateral SO, conversion to laparotomy, intraoperative complications, blood transfusions, postoperative complications, hemoglobin drop, hospital stay, and pain were the outcomes.	VH, LH
Hendawy et al[30]	RCT	Egypt	60	Inclusive research criteria was as follows: age older than 40 y, uterine size smaller than 12 wk, benign uterine pathology, BMI lower than 25, multiparous women, and vaginal prolapse	Exclusion criteria was as follows: age younger than 40 y, uterine size greater than 16 wk, malignant uterine pathology, intra-abdominal adhesions, eg, attributable to laparotomy and previous uterine scar, nulliparous, contraindication of laparoscopy (eg, severe cardiac and chest diseases)	Estimated blood loss and need for blood transfusion, operative time, intraoperative complications, and requirement for laparotomy attributable to whichever surgical difficulty or slipped surgical pedicle or intestinal or urinary tract surgical insult; postoperative complications, postoperative pain evaluation with the VAS and	VH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						requirement for analgesia, postoperative hospital stay, and wound infection	
Hwang et al[21]	RCT	Taiwan	60	Woman scheduled for hysterectomy for uterine leiomyomas in the Department of Gynecology and Obstetrics at Shin Kong Wu Ho-Su Memorial Medical Center, Taipei, Taiwan	Patients who were admitted under the indications of adenomyosis, uterine prolapse, chronic pelvic pain, dysfunctional uterine bleeding, cervical dysplasia, or pelvic inflammatory disease were excluded from the study	Duration of the surgery was measured from the first incision until the patient left the operating room; surgery was additionally separated into those that included or did not include a second procedure, including oophorectomy with or without adhesiolysis. The surgical nurse estimated the amount of bleeding in a routine manner. If a blood transfusion was performed, the number of units of transfused blood was recorded. The specimen weight was obtained immediately after the surgery. Complications were recorded as follows: *febrile morbidity* (defined as a tympanic temperature 38.3° C or higher 24 hours after surgery); an excessive amount of bleeding or hemorrhage requiring transfusion intraoperatively; injury to a major blood vessel or major organ, including the bowel, bladder, or ureter; and readmission to the hospital during the	TVH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						follow-up period for a problem directly related to surgery.	
Mohammed et al[32]	RCT	Egypt	50	Inclusion criteria were age ranging between 40 and 70 y, presence of a benign cause for hysterectomy, and uterine weight more than 280 g	Patients with obesity (BMI higher than 30), those with history of endometriosis or previous myomectomy, patients with suspected or known gynecologic malignancy, and cases with severe cardiopulmonary compromise were excluded from the study	The primary outcome measured was postoperative hospital stay. Intraoperative blood loss, hospital costs, and postoperative complications were among the secondary outcomes.	VH, LAVH
Ottosen et al[19]	RCT	Sweden	80	The inclusion criteria were menorrhagia, leiomyomas smaller than 15 cm in diameter, dysplasia, endometrial atypia, and pain	Women with ovarian pathology, uterus larger than 16 wk of gestational size, previously known dense adhesions, narrow vagina, or obviously inaccessible uterus were all excluded	Time for surgery, amount of bleeding, weight of the uterus, hemoglobin level, and postoperative complications	VH, LAVH
Ribeiro et al[35]	RCT	Brazil	40	60 consecutive patients registered at the Gynecological Clinic of Sao Paulo University School of Medicine Hospital with surgical indication for total hysterectomy were selected	The criteria for exclusion were uterine volume greater than 400 mL; use of any anti-inflammatory during the last 3 mo; diabetes mellitus; coagulation disorders; and autoimmune diseases	Operative time, blood loss, and inflammatory response were the outcomes.	VH, LH
Roy et al[17]	RCT	India	90	Women with benign pathology of the uterus not amenable to or failed medical management were considered for enrollment	Primary exclusion criteria were genital malignancy, acute pelvic inflammatory disease, and utero-vaginal descent greater than 1st degree. Patients with any contraindication to laparoscopy, including underlying medical	For each patient, intraoperative parameters, including total duration of surgery and blood loss, were recorded as primary outcome measures. Surgical difficulty;	NDVH, TLH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
					conditions that could be worsened by pneumoperitoneum or Trendelenburg position, were also excluded from the study	intraoperative complications; postoperative complications such as pain, febrile morbidity, or infection; total duration of hospital stay; satisfaction; and sexual dysfunction were recorded as secondary outcome measures.	
Roy et al[18]	RCT	India	20	Women with benign pathology of uterus who had estimated uterine weight between 300 and 1,500 g and were planned for hysterectomy were included in the study	Exclusion criteria were genital malignancy, acute pelvic inflammatory disease, uterovaginal descent greater than 1st degree, and any contraindication to laparoscopy	Blood loss, operating time, postoperative analgesia requirement, hospital stay, and morbidity were recorded in all cases.	NDVH, LAVH
Sesti et al[23]	RCT	Italy	80	Inclusion criteria were presence of symptomatic or rapidly growing myomas; age younger than 55 y; uterine size 12 wk of gestation or larger	Exclusion criteria were nulliparous women, uterine size 16 wk of gestation or larger, previous uterine surgery, suspected malignant gynecologic disease	Operation time, blood loss, paralytic ileus time, and postoperative pain were the outcomes.	VH, LAVH
Sesti et al[25]	RCT	Italy	100	Inclusion criteria were presence of symptomatic or rapidly growing myomas, age less than 55 y, and uterine size greater than or equal to 12 wk of gestation	Exclusion criteria were nulliparous women, uterine size greater than or equal to 16 wk of gestation, previous uterine surgery, and suspicion of malignant gynecologic disease	The primary outcome was the difference in hospital discharge time. Secondary outcomes were differences in the main operative data: operating time (calculated from skin or vaginal incision to closure); blood loss (estimated by calculating the blood volume of the suction machine during surgery, excluding liquid used for intraperitoneal	VH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						washing, and by weighing swabs); paralytic ileus time (calculated in hours from the end of the procedure to the ability to pass feces or gas); intraoperative complications; febrile morbidity (oral temperature of 38°C on two occasions 6 hours apart excluding the first 24 h after surgery); intensity of postoperative pain; and early postoperative complications (any unfavorable episodes occurring within 30 d after surgery requiring readmission, blood transfusion, or repeat surgery). Intraoperative complications were bowel, urinary, or vascular damage.	
Sesti et al[24]	RCT	Italy	108	Inclusion criteria were presence of symptomatic or rapidly growing myomas, age younger than 55 y, and uterine size 12 wk of gestation or larger (12 cm long)	Exclusion criteria were nulliparous women, uterine size 16 wk of gestation or larger (16 cm long), previous uterine surgery, and suspected malignant gynecologic disease	The primary outcome of the trial was the comparison between the three procedures in terms of discharge time. Secondary outcome measures were differences in operating time, blood loss, paralytic ileus time, intraoperative complications, intensity of postoperative pain, febrile morbidity (body temperature38°C or higher in two	VH, TLH, LAVH

(*continued*)

Table 1. Summary of the Included Studies (*continued*)

Study	Study Design	Country	No. of Patients	Main Inclusion Criteria	Exclusion Criteria	Outcomes	Method
						consecutive measurements 4 or more h apart), and early postoperative complications (any unfavorable episode occurring within 30 d from surgery requiring readmission, blood transfusion, repeat surgery).	
Soriano et al[28]	RCT	France	77	Inclusion criteria included uterine size larger than 280 g and one or more of the following: previous pelvic surgery, history of pelvic inflammatory disease, moderate or severe endometriosis, concomitant adnexal masses, or indication for adnexectomy	Exclusion criteria included suspicious adnexal mass and anesthetic contraindications for laparoscopic surgery. Women with contraindications to acetaminophen (allergy, liver disease) or nonsteroidal anti-inflammatory drugs (esophago-gastroduodenal disease, renal insufficiency, abnormal coagulation) were excluded	Operative time, hemoglobin drop, hospital stay, and analgesics use were the outcomes.	VH, LAVH
Zhu et al[37]	RCT	China	69	All patients had indication for hysterectomy	—	Operation time, blood loss, operation fee, pain score, hospital stay, morbidity, fever, and bowel recovery were the outcomes.	TVH, LAVH

RCT, randomized controlled trial; VHO, vaginal hysterectomy with bilateral oophorectomy; LAVHO, laparoscopically assisted vaginal hysterectomy with bilateral oophorectomy; TLH, total laparoscopic hysterectomy; LH, laparoscopic hysterectomy (includes LAVH and TLH); VH, vaginal hysterectomy; AH, abdominal hysterectomy; VAS, visual analog pain scale; LAVH, laparoscopically assisted vaginal hysterectomy; CIN, cervical intraepithelial neoplasia; PC, peritoneal closure; ICIQ-FLUTS, International Consultation of Incontinence Questionnaire–Female Lower Urinary Tract Symptoms; ICIQ-VS, International Consultation of Incontinence Questionnaire–Vaginal Symptoms; NDVH, nondescent vaginal hysterectomy SF-12, 12-Item Short Form; POP-Q, pelvic organ prolapse quantification; SO, salpingo-oophorectomy; BMI, body mass index.

Table 2. Baseline Characteristics of Included Participants

	Age (y)						BMI					
	VH			LH			VH			LH		
Study	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Agostini et al[40]	55	6.3	24	53	3.5	24	26.7	5.3	24	25.2	2.6	24
Allam et al[31]	53.67	10.11	30	54.67	11	30	27.1	2.5	30	25.1	3.3	30
Candiani et al[11]	51.26	8.8	30	48.96	8.9	30	27.2	6.3	30	24.4	4.2	30
Chrysostomou et al[34]	47.1	9.9	151	45.5	8	76	29.1	6.8	151	27.4	6.3	76
Darai et al[27]	49.1	4.7	40	50.2	6.8	40	NR	NR	NR	NR	NR	NR
Drahonovsky et al[13]	47.7	NR	40	47.6	NR	41*	27.4	NR	40	26.6	NR	41*
				48.9	NR	44†				25.6		44†
Eggemann et al[38]	46.85	6	97	45.1	5.85	95	28.2	5	97	26.8	4.9	95
Ekanayake et al[36]	47.6	7.3	49	47.4	5.6	49	25.72	4.5	49	25.19	3.88	49
Ekanayake et al[20]	47.1	8.2	49	48.1	6.8	49	25.7	5.05	49	25	6	49
Garry et al[33]	40.8	6.5	168	40.9	6.9	336	26.5	4.7	168	26.4	5.1	336
Ghezzi et al[12]	48	3.5	41	48	11.25	41	25.3	4.2	41	25.3	4.7	41
Hendawy et al[30]	46	2.8	30	45.2	2.7	30	25.5	1.7	30	25.6	1.8	30
Hwang et al[21]	46	4	30	44	5	30	22	2.6	30	23	3.4	30
Mohammed et al[32]	48.44	6.4	25	47.72	4.24	25	27.28	1.54	25	27.24	1.39	25
Ottosen et al[19]	49	5.5	40	48	12.25	40	25.8	4.8	40	24.8	3.6	40
Ribeiro et al[35]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Roy et al[17]	43.7	NR	30	41.9	NR	30*	26.09	NR	30	25.44	NR	30*
				43.4	NR	30†				27.38	NR	30†
Roy et al[18]	43	NR	10	41.6	NR	10	24	NR	10	21.8	NR	10
Sesti et al[23]	48.8	0.7	40	48	0.5	40	25.4	0.6	40	25.8	0.6	40
Sesti et al[25]	47.8	0.5	50	49	0.7	50	26.4	0.6	50	24.8	0.6	50
Sesti et al[24]	49	4.4	36	49.7	5.3	36*	25.1	3.6	36	27.4	5.8	36*
				48.2	3.3	36†				26.2	3.4	36†
Soriano et al[28]	49.1	4.7	40	49.3	4.8	37	NR	NR	NR	NR	NR	NR
Zhu et al[37]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

	Uterine Weight (g)						Parity				
	VH			LH			VH			LH	
Study	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Agostini et al[40]	267.7	198.8	24	303.2	193	24	1.8	1.6	24	2	1.5
Allam et al[31]	156.67	70.1	30	155	39	30	4	7.8	30	2.33	4.67
Candiani et al[11]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chrysostomou et al[34]	91.5	90.1	151	88.4	50.2	76	2.67	4.5	151	2.167	1.13
Darai et al[27]	NR	NR	NR	NR	NR	NR	2.7	2.6	40	1.6	1.1
Drahonovsky et al[13]	NR	NR	NR	NR	NR	NR	1.6	NR	40	1.5	NR
				NR	NR	NR				1.4	NR
Eggemann et al[38]	147.5	76.5	97	168.5	85.5	95	NR	NR	NR	NR	NR
Ekanayake et al[36]	118.33	47.35	49	146.67	47.08	49	2.83	1.14	49	2.83	1.14
Ekanayake et al[20]	118.33	47.35	49	147	74.84	49	2.83	1.14	49	2.83	1.14
Garry et al[33]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ghezzi et al[12]	150	100	41	190	102.5	41	NR	NR	NR	NR	NR
Hendawy et al[30]	NR	NR	NR	NR	NR	NR	3	1	30	3.3	1
Hwang et al[21]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mohammed et al[32]	NR	NR	NR	NR	NR	NR	4.2	1.66	25	3.67	0.93
Ottosen et al[19]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ribeiro et al[35]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Roy et al[17]	204.9	NR	30	137.16	NR	30*	3	NR	30	3	NR
				164.64	NR	30†				4	NR
Roy et al[18]	415.3	NR	10	358.5	NR	10	2.3	NR	10	2.5	NR
Sesti et al[23]	320	17	40	335	18	40	2.2	0.2	40	2.1	0.2

(*continued*)

Table 2. Baseline Characteristics of Included Participants (*continued*)

	Uterine Weight (g)						Parity				
	VH			LH			VH			LH	
Study	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Sesti et al[25]	330	19	50	345	21	50	2	0.2	50	2.1	0.2
Sesti et al[24]	319.2	107	36	309.1	88	36*	2	0.9	36	1.9	0.7
				318.9	100	36†				1.8	0.6
Soriano et al[28]	424	211	40	481	329	36	2.7	2.6	40	1.6	1.1
Zhu et al[37]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

BMI, body mass index; VH, vaginal hysterectomy; LH, laparoscopic hysterectomy; NR, not reported.
* Total laparoscopic hysterectomy.
† Laparoscopically assisted vaginal hysterectomy.

Wound dehiscence rates were none in the vaginal hysterectomy group compared with 1.4% in the laparoscopic hysterectomy group (P=.11, Appendix 11, available online at http://links.lww.com/AOG/D463). The mean decrease in hemoglobin levels postoperatively was −1 for vaginal hysterectomy and −0.87 for laparoscopic hysterectomy (mean difference −0.13, 95% CI −0.15 to 0.41, P=.37, I^2=56%) and −1.59 for vaginal hysterectomy and −1.39 for laparoscopic hysterectomy on the first postoperative day

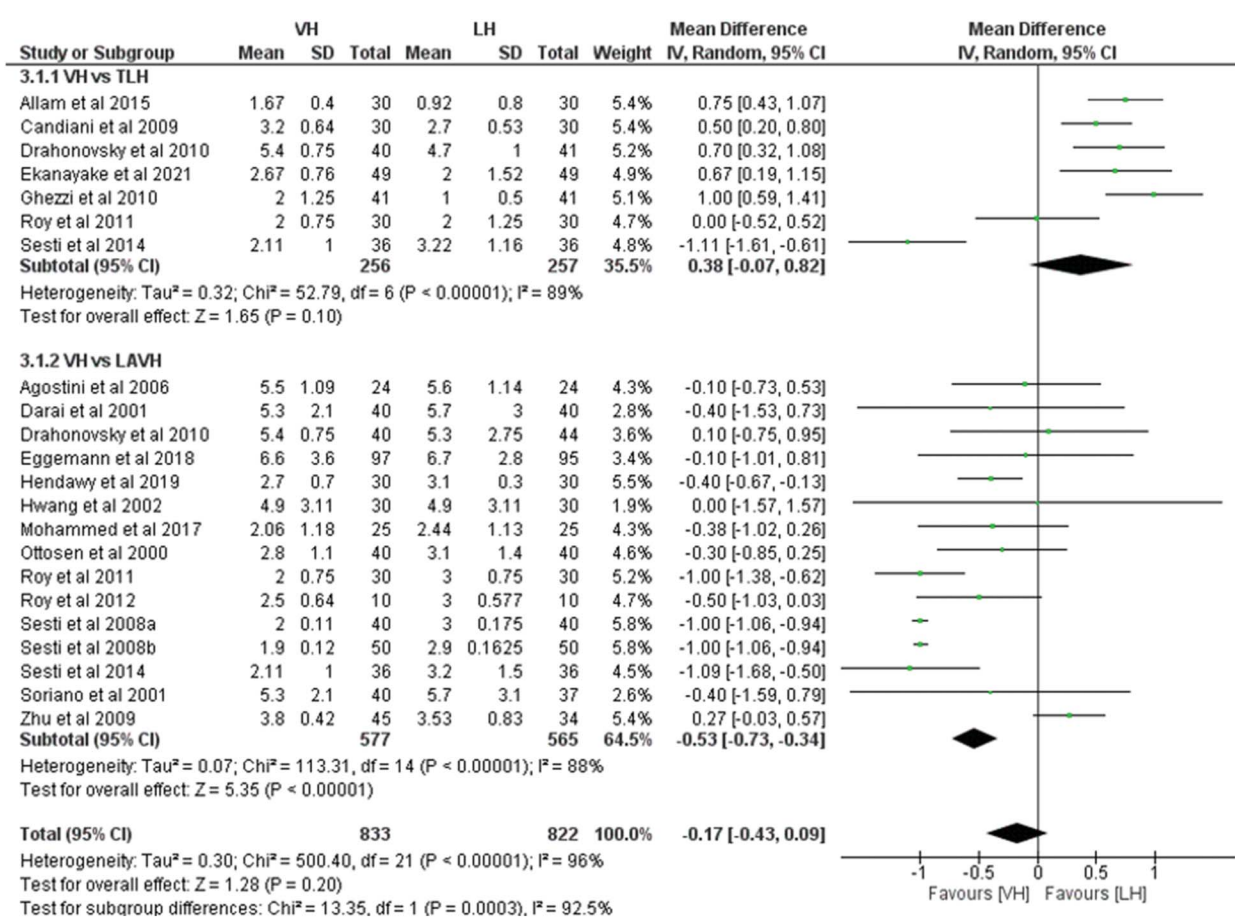

Fig. 2. Meta-analysis of length of hospital stay. VH, vaginal hysterectomy; LH, laparoscopic hysterectomy; IV, independent variable; TLH, total laparoscopic hysterectomy; df, degrees of freedom; LAVH, laparoscopic-assisted vaginal hysterectomy.
Azadi. Vaginal vs Laparoscopic Hysterectomy in Benign Gynecologic Conditions. Obstet Gynecol 2023.

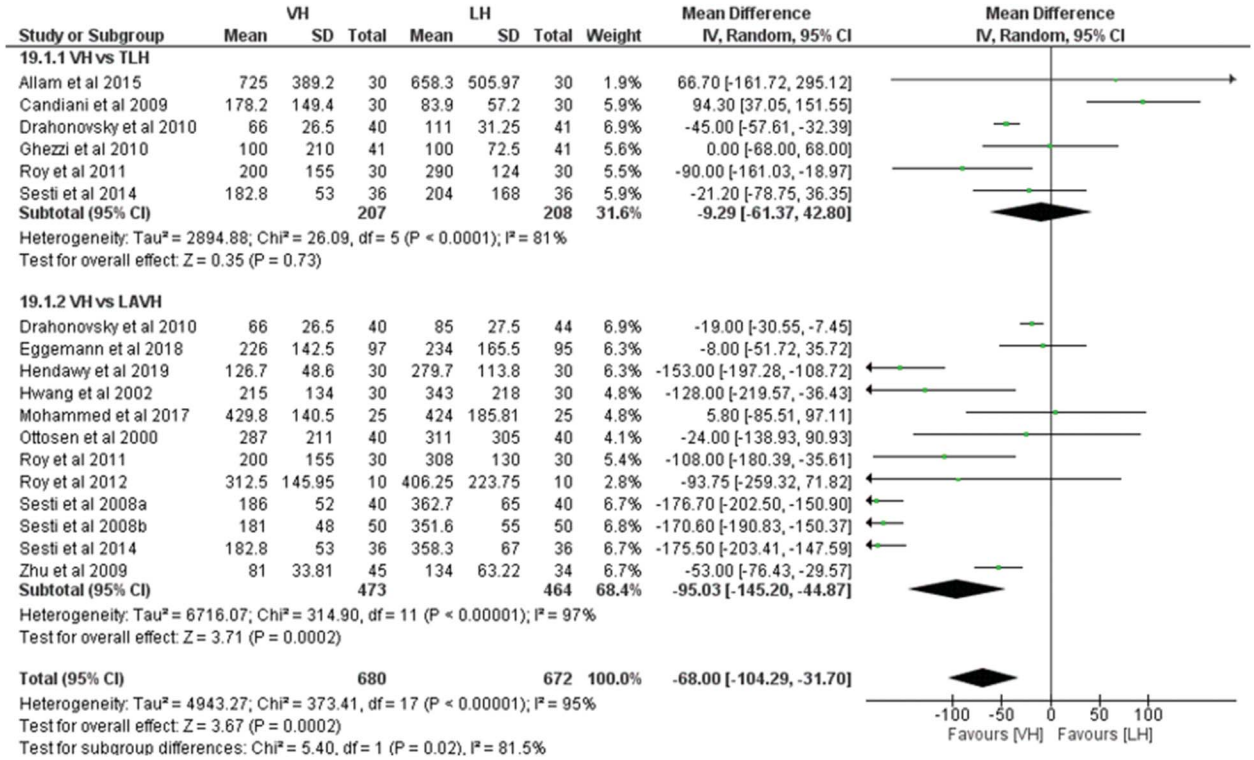

Fig. 3. Meta-analysis of estimated blood loss. VH, vaginal hysterectomy; LH, laparoscopic hysterectomy; IV, independent variable; TLH, total laparoscopic hysterectomy; df, degrees of freedom; LAVH, laparoscopic-assisted vaginal hysterectomy.
Azadi. Vaginal vs Laparoscopic Hysterectomy in Benign Gynecologic Conditions. Obstet Gynecol 2023.

(mean difference −0.2, 95% CI −0.43 to 0.02, P=.08, I^2=7%) (Appendices 12 and 13, available online at http://links.lww.com/AOG/D463). The rate of pelvic hematoma was 9.8% for vaginal hysterectomy and 5.9% for laparoscopic hysterectomy (OR 1.73, 95% CI 0.92–3.26, P=.09, I^2=10%), and the rate of thromboembolism was 0.51% for vaginal hysterectomy and 0.54% for laparoscopic hysterectomy (OR 1, 95% CI 0.15–6.64, P=1, I^2=0%) (Appendices 14 and 15, available online at http://links.lww.com/AOG/D463).

The pooled analysis of data on urinary tract infection (UTI) showed that the vaginal hysterectomy group (1/229) was associated with a lower UTI rate compared with the laparoscopic hysterectomy group (11/230) (OR 1.73, 95% CI 0.92–3.26, P=.03, I^2=0%) (Appendix 16, available online at http://links.lww.com/AOG/D463). Other infections were rare, including surgical site or wound infection, vaginal cuff infection, and other or unspecified infection rates (Appendices 17–19, available online at http://links.lww.com/AOG/D463).

Secondary to limited data, LAVH and total laparoscopic hysterectomy groups were combined into an laparoscopic hysterectomy group for these analyses, and nondescent vaginal hysterectomy results were combined with all other vaginal hysterectomy results. Four studies[11,12,31,40] used the visual analog pain scale scores to evaluate the postoperative pain of their patients on the day of surgery. Five studies[11,12,20,21,38] evaluated the pain scores on the first postoperative day. Three studies[11,20,38] evaluated the pain scores on the second postoperative day. A difference between pain scores was found in data that evaluated postoperative pain scores only on the day of surgery, and this favored laparoscopic hysterectomy over vaginal hysterectomy (mean difference 1.66, 95% CI 0.19–3.13, P=.03, I^2=95%). No difference was found between studies that evaluated pain scores on the first or second postoperative day (mean difference 0.24, 95% CI −0.74 to 1.22, P=.63, I^2=87% and mean difference 0.16, 95% CI −0.61 to 0.92, P=.69, I^2=70%, respectively) (Appendices 20–22, available online at http://links.lww.com/AOG/D463).

The quality of life analysis is described in Appendix 2, http://links.lww.com/AOG/D463. Funnel plots were performed to examine the potential for publication bias with regard to operative time, blood transfusion, and postoperative fever (Appendices 23–

25, available online at http://links.lww.com/AOG/D463). The funnel plots resemble a symmetric funnel, and all studies fell within the 95% CI axis, suggesting that the risk of publication bias is low.

DISCUSSION

Vaginal hysterectomy takes about 35 minutes less than laparoscopic hysterectomy and is associated with less blood loss and a faster recovery time (by 2.7 days). Our findings also noted decreased blood loss and UTI rates in the vaginal hysterectomy group.

These findings are at odds with some previous literature on this topic. Agostini et al[40] compared vaginal hysterectomy with bilateral oophorectomy without laparoscopic assistance and LAVH with bilateral oophorectomy and found a significantly higher rate of complications in the laparoscopic-assisted approach. Complications in this 24-patient laparoscopic group included intraoperative blood loss of greater than 500 mL in 8 of the patients, as well as two trocar port hematomas, two vaginal cuff hematomas, and one case of postoperative fever.[40]

In total, 11 of the included RCTs[13,18,19,21,23,25,27,30,32,34,38] compared vaginal hysterectomy and LAVH specifically. In a study by Chrysostomou et al,[34] notable findings included longer operative time and higher costs associated with LAVH, likely attributable to the consumption of disposable equipment. Darai et al[27] reported similar results in addition to showing a statistical difference in the complication rate, which favored the vaginal hysterectomy group. Another RCT by Drahonovsky et al[13] demonstrated that total laparoscopic hysterectomy had the longest operative time and that LAVH had the highest blood loss. Sesti et al[23] compared LAVH and vaginal hysterectomy in enlarged myomatous uteri with better results in the vaginal hysterectomy group.

In contrast, many other studies have reported no difference in some outcomes between vaginal hysterectomy and total laparoscopic hysterectomy.[19,24,31,33] Allam et al[31] compared total laparoscopic hysterectomy, vaginal hysterectomy, and abdominal hysterectomy and found that postoperative pain scores and hospital stay length were significantly lower in the total laparoscopic hysterectomy group. In a study by Ekanayake et al[36] comparing nondescent vaginal hysterectomy and total laparoscopic hysterectomy with abdominal hysterectomy, there was no significant difference between the three groups for recovery time. This study also reported that nondescent vaginal hysterectomy and total laparoscopic hysterectomy were most cost effective if performed in specialized centers, but abdominal hysterectomy was more cost effective in rural areas.[20] In a study by Ghezzi et al,[12] total laparoscopic hysterectomy was superior over vaginal hysterectomy in terms of postoperative pain, need for analgesics, and length of hospital stay.

The most recent Cochrane review on this topic, published in 2015, compared several different modes of hysterectomy. There were 16 RCTs included in the vaginal hysterectomy compared with laparoscopic hysterectomy analysis, and there was no statistical difference between both groups for short-term, long-term or intraoperative complications.[5] Although most of their results were consistent with ours, our updated review identified differences between vaginal hysterectomy and total laparoscopic hysterectomy that may be helpful to clinicians.

A review in 2017 by Sandberg et al[41] included 4,969 women in the vaginal hysterectomy group and 3,955 in the total laparoscopic hysterectomy group but included prospective and retrospective cohort studies, comparative case series, and RCTs. They reported superiority in the vaginal hysterectomy group for surgical cost, lower laparotomy conversion rate, and shorter operative time.[41] Two other systematic reviews by Andres et al in 2017[42] and Lee et al in 2019[43] revealed no differences between vaginal hysterectomy and laparoscopic hysterectomy for efficacy or safety, but again, those reviews included fewer studies than our current review.

Our systematic review and meta-analysis is a comprehensive study comparing vaginal hysterectomy and laparoscopic hysterectomy. This is an update to the latest systematic review done by Lee et al[43] that included 18 studies with a total population of 1,618 patients; our systematic review includes 23 RCTs with a total population of 2,408. The inclusion of only RCTs in the meta-analysis is a strength. In addition, our review followed PRISMA guidelines strictly and was performed in accordance with the Cochrane Handbook of Systematic Reviews for Interventions.

The main limitations of this study are the high heterogeneity in secondary outcomes and the necessity to group LAVH and total laparoscopic hysterectomy in some calculations. Second, all RCTs excluded hysterectomies performed for the indication of uterine prolapse, limiting the usefulness of these data for prolapse. It is important to note that many of the complications and adverse events were uncommon, and because this study is underpowered to evaluate differences in these small rates, we provide quantitative data but do not conclude nonsignificance between groups. Minimal information was provided

on learning curves or surgeon experience in the included RCTs, which could be associated with outcomes. The inability to stratify data by hysterectomy indication is a major limitation, effectively preventing us from evaluating outcomes according to specific indications. Future clinical trials with larger populations and stratification based on surgical indication would help address this issue.

In conclusion, when feasible, vaginal hysterectomy may be the preferred approach of hysterectomy because it requires less time during surgery, results in less blood loss and lower urinary tract infection rates, and promotes faster recovery, with the tradeoff that it may be associated with increased immediate postoperative pain.

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