Chirurgia (Bucur). 2025 September, Online Ahead of Print

http://dx.doi.org/10.21614/chirurgia.3172

Strategic Challenges of Hysterectomy in Benign Gynecological Pathology – Perspectives from a Systematic Review

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Rezumat

Provocările strategice ale histerectomiei în patologia ginecologică benignă - o analiză sistematică a literaturii

Histerectomia este cea mai frecventă intervenție chirurgicală nonobstetricală efectuată la femei de toate vârstele şi reprezintă un punct comun între chirurgie şi ginecologie, aceasta având multiple căi de abord. Absența unui consens clar privind criteriile standardizate de selecție în cazul patologiei benigne, conduce la variabilitate şi decizii care nu reflectă particularitățile fiecărui caz în parte. Acesta este un review sistematic de tip narativ ce are ca obiective identificarea şi sistematizarea criteriilor raportate în literatura de specialitate privind selecția tehnicii chirurgicale pentru histerectomie, furnizând o bază informativă pentru o abordare individualizată şi eficientă cu intenția de a sprijini o decizie chirurgicală personalizată, bazată pe dovezi. Am realizat o cercetare sistematică în bazele de date: PubMed, Cochrane Library şi Embase, în perioada 01/01/2015 - 01/06/2025, având în vedere doar studii randomizate controlate în limba engleză, iar strategia de căutare a inclus termeni controlați şi termeni liberi, combinați prin operatori booleeni. Am selectat cele mai relevante opt studii, cu un nivel de încredere ridicat în urma evaluării calității şi cu rezultate concordante cu restul literaturii. Alegerea tehnicii chirurgicale optime trebuie individualizată, ținând cont de o evaluare detaliată a fiecărei paciente şi de expertiza echipei medicale, cu scopul de a obține cele mai bune rezultate funcționale şi de calitate a vieții după intervenție.

Cuvinte cheie: histerectomie laparoscopică, histerectomie vaginală, histerectomie abdominală, patologie ginecologică benignă

Received: 01.07.2025
Accepted: 30.08.2025

Abstract

Hysterectomy is the most common non-obstetric surgical procedure

performed in women of all ages, representing a point of intersection between surgery and gynecology, with multiple possible approaches. The lack of a clear consensus on standardized selection criteria for benign pathology results in variability and decisions that may not accurately reflect the specific characteristics of each case. This is a narrative systematic review aimed at identifying and organizing the criteria reported in the literature regarding the selection of surgical techniques for hysterectomy, providing an informative foundation for an individualized and practical approach that supports evidence-based, personalized surgical decision-making. We performed a systematic search in the PubMed, Cochrane Library, and Embase databases between January 1, 2015, and June 1, 2025, considering only English-language randomized controlled trials. The search strategy included both controlled and free terms, combined using Boolean operators. We selected the eight most relevant studies, with a high level of confidence following the quality assessment and consistent findings with the specialized literature. The choice of the optimal surgical technique should be individualized, based on a thorough evaluation of each patient and the expertise of the medical team, to achieve the best possible functional outcomes and quality of life after the intervention.

Keywords: laparoscopic hysterectomy, vaginal hysterectomy, abdominal hysterectomy, benign gynecologycal pathology, RCT, hysterectomy approach

Introduction

Benign gynecologic pathologies such as uterine leiomyomas, adenomyosis, cervical dysplasia, or abnormal uterine bleeding unresponsive to conservative treatment are often managed surgically. Hysterectomy is the most frequently performed non-obstetric surgical procedure in women of all ages and represents a common ground between surgery and gynecology, with multiple possible approaches. In recent years, minimally invasive techniques such as laparoscopy and robotic surgery have gained prominence, and it is well established that laparoscopic hysterectomy has substantially improved the quality of life after the procedure compared to the classical approach (1,2).

Most surgical interventions for benign gynecologic conditions are feasible via laparoscopy, although this technique has certain limitations. Its advantages over open surgery are well established, but it should not be regarded as a universal solution. In clinical practice, the vaginal and abdominal approaches are often preferred for hysterectomy in benign pathology.

Over time, numerous studies have attempted to compare surgical approaches for benign gynecologic pathology, as well as complication rates associated with each of the three main techniques, alongside other variables such as intraoperative blood loss, postoperative pain, recovery time, and length of hospitalization, factors that will also be considered in this paper in an attempt to solve the proposed objectives. This narrative systematic review identify and synthesize the criteria reported in the literature regarding surgical technique selection for hysterectomy, providing an informative foundation for an individualized and practical approach that supports evidence-based, personalized surgical decision-making.

Based on current evaluations of the effectiveness of various total hysterectomy approaches in benign gynecologic conditions, vaginal hysterectomy is considered to carry the lowest risk among the known techniques (3). However, the success of the intervention is directly proportional to a good knowledge of the method practiced and the severity of the pathology. Therefore, surgeons must remain discerning in choosing the safest and most cost-effective surgical approach associated with the best results for each patient.

This narrative systematic review identify and synthesize the criteria reported in the literature regarding surgical technique selection for hysterectomy, providing an informative foundation for an individualized and practical approach that supports evidence-based, personalized surgical decision-making. The choice of optimal surgical approach is influenced by a series of complex factors, including anatomical and pathological characteristics, the surgeon's level of experience, and the patient's expressed preferences.

Nevertheless, the absence of a clear consensus on standardized selection parameters for benign hysterectomy leads to variability and decisions that may not fully reflect the particularities of each case. In light of the diversity of available

options, establishing well-defined criteria is crucial to support the selection of the most suitable approach for each patient, intended to maximize benefits and minimize risks.

The study aims to provide an updated review of the available evidence on factors that could guide the choice of the optimal surgical approach for total hysterectomy.

Objectives:

- To identify and synthesize the criteria used in choosing the optimal approach for hysterectomy (laparoscopic, vaginal, or abdominal) in benign gynecological pathology.
- To highlight the need for individualized selection to maximize postoperative benefits.

Materials and Methods

We conducted a systematic literature search across the following databases: PubMed, Cochrane Library, and Embase, spanning a ten-year period from January 1, 2015, to June 1, 2025, and considering only English-language randomized controlled trials (RCTs).

The protocol was registered in PROSPERO with ID: CRD420251083505 to ensure transparency, prevent research duplication, and support the methodological validity of the review.

The search strategy included both controlled terms (MeSH, Emtree) and free-text terms, combined using the Boolean operators ”AND” and ”OR” to maximize search sensitivity. The specific keywords used were: hysterectomy, vaginal, laparoscopic, abdominal, and benign gynecological conditions. Example of the syntax used: ["hysterectomy" (MeSH Terms) OR hysterectomy(tiab)] AND ["benign gynecological conditions"(MeSH Terms)] AND (vaginal OR abdominal OR laparoscopic) AND RCT.

Since the initial advanced search yielded 455 studies related to the topic over the last decade, we refined the search using keywords corresponding to the parameters we aimed to analyze, such as operative time, blood loss, and postoperative pain, with a particular emphasis on recovery and quality of life. This reduced the number of studies by nearly half. After removing duplicates, we manually excluded alternative techniques that are not part of the comparisons of this review by screening them by title (single-port laparoscopic hysterectomy, laparoscopic-assisted vaginal hysterectomy, natural orifice transluminal endoscopic surgery, robotic hysterectomy). Many studies that used the term “laparoscopic hysterectomy” in their description referred to alternative minimally invasive techniques and were, therefore, outside the scope of our investigation.

As we mention, after applying preliminary selection criteria and removing duplicates, 165 studies were screened based on titles or abstracts. Subsequently, 32 articles were assessed in full for eligibility, 28 were recover, and 10 studies were included in the ROB2 analysis according to the established criteria. The entire study selection process was systematized and graphically presented using the PRISMA diagram (*Fig. 1* - section ”Results”), which provides a detailed illustration of each step undertaken and the reasons for exclusion.

All the studies relevant to the predefined PICO research question (*Table 1*) were independently reviewed by two authors (N.A.M. and A.I.), and eight conclusive studies were selected to meet the objectives. Study selection was carried out in the following stages: title and abstract screening, followed by full-text analysis for eligibility and quality assessment.

Inclusion criteria:

- RCTs in English, describing criteria for choosing the approach for hysterectomy;
- RCTs comparing hysterectomy techniques (vaginal, abdominal, laparoscopic);
- adult female population with benign gynecological pathology.

Exclusion criteria:

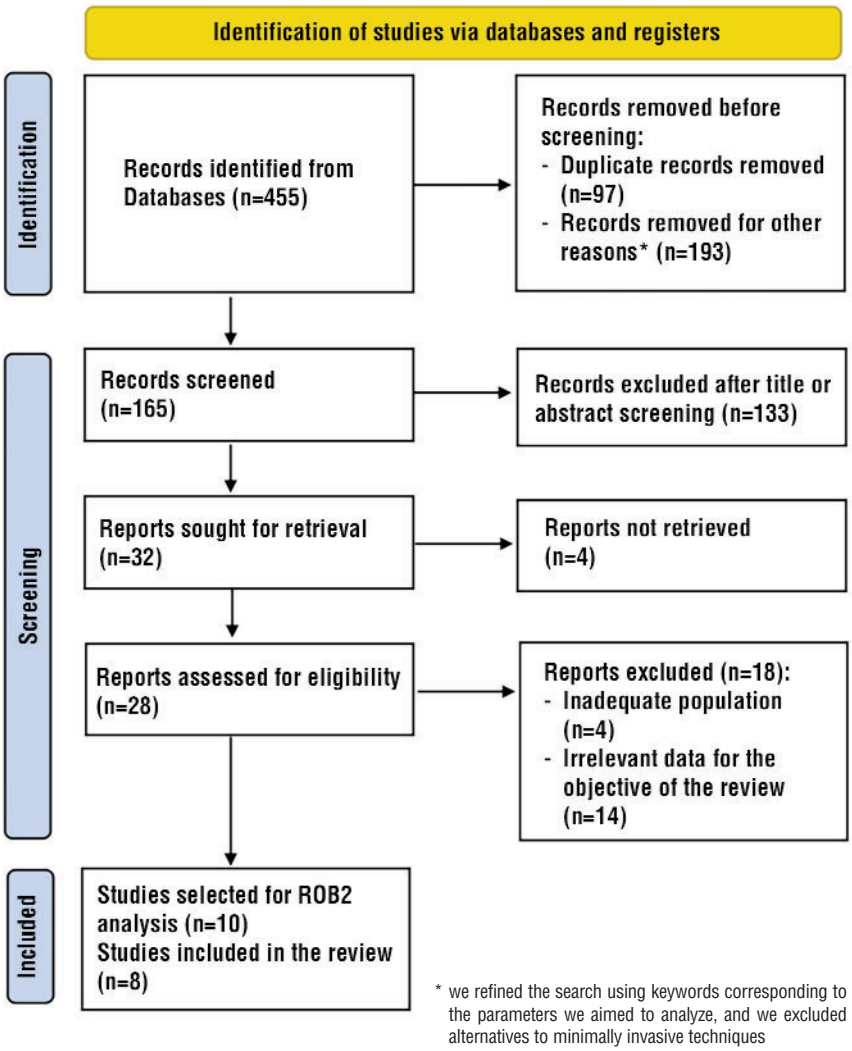
- malignant conditions;
- studies that analyzed alternative surgical techniques (e.g., robotic);
- studies that did not provide separate data for each surgical approach;
- observational studies, without precise comparative data between techniques.

The data extracted from each study included the following: citation, study design, year of

Table 1. PICO framework

Population	Intervention	Comparison	Outcomes
Adult patients, Benign gynecological pathology	Total Hysterectomy	Laparoscopic, Vaginal, Abdominal	Operative time, Recovery, Quality of Life

Figure 1. PRISMA Flow diagram



publication, study location, number of patients enrolled, the surgical techniques compared, and a summary of the results or conclusions.

In analyzing the studies, we considered both selection bias and reporting bias. Evaluating the quality of the studies was crucial in determining the extent to which the results were credible and free from error. We used the ROB 2 (Risk of Bias 2) tool, a standardized instrument developed by Cochrane for evaluating the risk of bias in randomized controlled trials (RCTs), classifying the risk as "low" (indicating high confidence in the results), "some concerns" (suggesting potential issues with validity), or "high" (indicating that the results may be influenced by study design or reporting). The Excel version ROB2_v9 was downloaded from https://www.riskofbias.info/welcome/rob-2-0-tool.

Results

Based on the inclusion and exclusion criteria outlined in the "Materials and Methods" section, we performed a final selection of eight studies published between 2015 and 2025, as presented in *Table 2*. The primary objective was to identify recent studies comparing all three surgical approaches to total hysterectomy: laparoscopic (LH), vaginal (VH), and abdominal (AH). However, given that only two studies met these criteria over the past decade, we widened the selection by grouping the techniques in pairs. Accordingly, we identified two studies comparing VH and AH, one study comparing LH and VH, and three studies comparing LH and AH.

Throughout the analyzed period, no neutral randomized controlled trials were found that

Table 2. Study selection process

Phases of Randomized Controlled Trial (RCT) Selection	Number of studies
Database search (PubMed, Cochrane, Embase)	455
After search refinement	262
After removing duplicates	165
Articles excluded after title and/or abstract screening	133
Full-text articles assessed for eligibility	32
Articles selected for ROB2 analysis	10
Articles included in the systematic review	8

offered a direct comparison of all three techniques. Nevertheless, relevant studies from earlier literature will be discussed in the "Discussion" section. Despite the intention to develop a review based on up-to-date data, no RCTs meeting our criteria were identified in the last five years, with most relevant studies dating from the beginning of the selected timeframe.

The study selection process for this systematic review is presented in *Fig. 1*, in accordance with PRISMA guidelines (4). The initial search conducted in the PubMed, Cochrane, and Embase databases identified 455 articles, but after refining the search and removing duplicates, 165 unique studies remained. Subsequently, 133 articles were excluded based on title and/or abstract screening, Of the 32 studies selected as eligible for full-text review, only 28 were successfully retrieved. Of these, 10 were selected for risk of bias analysis using the ROB2 tool, and 8 were included in the final review according to the predefined criteria. Reasons for exclusion during full-text assessment are detailed in the diagram.

The risk of bias (ROB) assessment for the eight RCTs was generally low for randomization, missing data, and outcome measures (*Table 3*, *Fig. 2*).

Table 3. Assessment of the quality of studies (according to ROB-2 domains)

Study	Randomisation process	Deviations	Missing outcome	Outcome	Reported results
Nanavati, 2016	Prospective RCT with 50 patients in each group: VH, AH, LH, ensuring comparability of the groups	The interventions were standardized, with no significant deviations from the original plan noted.	No significant data losses or withdrawals from the study were mentioned	Measurements included objective and subjective outcomes	All predefined outcomes were reported thoroughly and transparently
Allam, 2015	Details of the randomization method are not very clear in the abstract	No major problems with compliance with the intervention are mentioned	No significant losses or missing data were reported.	Outcomes (operative time, complications, pain) are objective.	The study appears to report all pre-specified outcomes.
Balakrishnan, 2016	RCT with 150 patients in each group: VH and AH	The interventions were standardized, with no significant deviations from the original plan noted.	Post-operative assessments were performed for all participants	Measurements included objective and subjective outcomes.	All outcomes were disclosed fully and with transparency.
Sajjad, 2021	Clear randomization, well-described method.	Allocation probably concealed. Interventions are surgical and difficult to blind.	The reported data are complete, with minimal losses.	Assessment of operative time and complications is objective.	The assessment method is not straight-forward, but outcomes are reported by the protocol.
Laky, 2017	Prospective RCT with adequate randomisation.	No significant deviations from the planned interventions were reported.	No meaningful loss of data or withdrawals from the study were reported	No significant differences were reported between groups in terms of outcome measures.	The results were made available with complete clarity and openness.
Chen, 2021	Randomization was mentioned, but details of the specific allocation method were not provided.	The interventions were standardized, and no conversions between intervention types were reported.	Three participants were lost to follow-up, but postoperative assessments were performed for the remaining 88 participants.	Measurements included objective and subjective outcomes.	All outcomes were disclosed fully and with transparency.
Kho, 2019	Randomization was described, but no precise details about the allocation were provided.	The interventions were standardized, and no conversions were reported	Minimal losses to follow-up, no significant impact on outcomes	Primary outcomes are objective, and measurement is accurate.	All expected outcomes were reported clearly.
Polat, 2016	Prospective RCT with 1:1 allocation. Balanced distribution suggests adequate randomization.	The interventions were standardized, and patients were followed according to the protocol.	No significant data loss or withdrawals from the study were mentioned.	No significant differences between groups were reported in terms of outcome measures	The results were reported plainly and comprehensively.

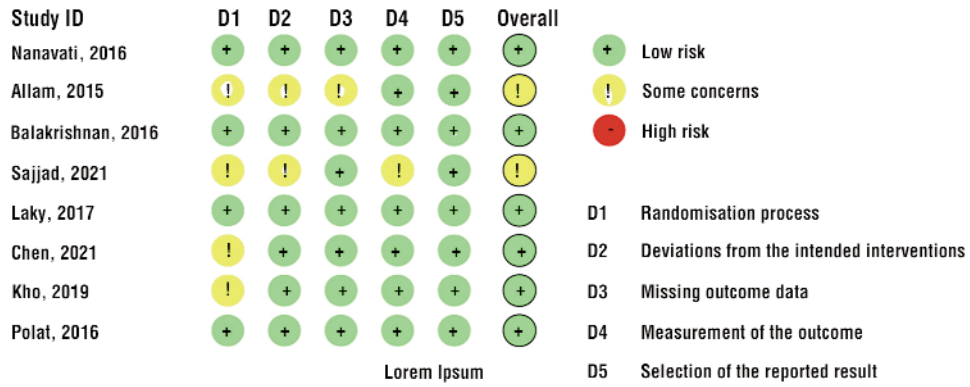


Figure 2. Risk of bias assessments for randomized controlled trials using the Cochrane Handbook Risk of Bias tools for randomized trials (RoB-2).

Domain 1 - bias arising from the randomization process,
Domain 2 - bias due to deviations from the intended interventions,
Domain 3 - bias due to missing outcome data,
Domain 4 - bias in measurement of the outcome,
Domain 5 - bias in the selection of the reported result.

Assessing the quality of the studies was essential in determining the credibility and reliability of the findings. No studies were identified as having a high risk of bias.

The variety of criteria used in the analyzed studies highlights the need for a multidimensional and personalized evaluation, which should also include patient-related factors. This individualization is essential for optimizing outcomes and reducing the risk of complications. Moreover, the experience of the operators or their level of surgical training was not mentioned in all studies and, therefore, was not considered a source of bias.

The data extraction process for this review was carried out collaboratively by all authors, taking into account the most relevant aspects for choosing one technique over another. We focused on operative time, which appears to be one of the most extensively analyzed parameters in the literature, as well as on variables that contribute to early patient recovery and enhancement of well-being, specifically: blood loss, postoperative pain, recovery, and overall quality of life.

Table 4. Centralization of RCTs by groups and the number of participants

Comparison	RCT	Number of patients
LH-VH-AH	2	240
VH-AH	2	390
LH-VH	1	100
LH-AH	3	477

Following a thorough selection, eight studies with a low overall risk of bias were included, demonstrating a high level of confidence in the results. These studies enrolled a total of 1,207 patients (*Table 4*), all of whom had indications for hysterectomy due to benign pathology. A summary of the reviewed studies is presented in *Table 5*.

In the first category, which compares LH, VH, and AH, we selected two randomized controlled trials: Nanavati et al. (2016) (5) and Allam et al. (2015) (6), both of which shared multiple equivalent outcomes.

Table 5. Summary of reviewed studies

Study	Location	Number of patients	Techniques
Nanavati AM, 2016	India	150	LH-VH-AH
Allam IS, 2015	Egypt	90	LH-VH-AH
Sajjad N, 2021	Pakistan	90	VH-AH
Balakrishnan D, 2016	India	300	VH-AH
Laky R, 2017	Austria	100	LH-VH
Chen JS, 2021	USA	91	LH-VH
Kho KA, 219	USA	94	LH-VH
Polat M, 2016	Turkey	292	LH-VH

Nanavati and colleagues published in 2016 a prospective, randomized, three-arm study conducted over 18 months, comparing 150 abdominal, vaginal, and laparoscopic hysterectomies, with an equal number of patients assigned to each technique. Patients were selected to be eligible for any of the three interventions. After analyzing clinical parameters such as procedure duration, blood loss, postoperative pain, complications, and average hospital stay, the conclusion was that laparoscopy emerged as the preferred candidate for hysterectomy. Although it had the longest operative time (180 minutes vs. 75 minutes for VH and 77.5 minutes for AH), the laparoscopic approach ranked highest in terms of minimal intraoperative bleeding and fewer complications, along with favorable cosmetic results. However, the authors noted that VH remains the method of choice, offering several advantages similar to LH, such as minimal pain and faster recovery (5).

The second study comparing all three techniques was conducted by Allam et al. in 2015. This was a prospective randomized trial including a total of 90 patients with benign gynecological pathology who underwent hysterectomy using the bipolar electrosurgical vessel sealing (EBVS) technique. The monitored parameters were similar to those reported by Nanavati et al. Regarding procedure duration, LH once again had the longest operative time (VH = 100.4 ± 35.8 min < AH = 123.6 ± 44.5 min < LH = 126 ± 42.7 min), yet with multiple well-known benefits such as reduced blood loss and pain, as well as quicker recovery, as indicated by a shorter hospital stay compared to VH and AH. Using the EBVS technique, no significant differences were observed between the vaginal and open approaches. Although more frequent complications were reported in the VH and AH groups compared to the LH group, these differences were not statistically significant (6). In this study, the procedure duration exceeded the results reported by Nanavati et al., but this may be attributed to the EBVS technique used. Operative durations tend to vary among institutions and practitioners, reflecting differences in surgical approach and training. However, a consistent hierarchy in technique-related timing is observed: LH > AH > VH.

When comparing vaginal hysterectomy with the abdominal approach, we selected two relevant studies that reported patient-centered outcomes: Balakrishnan et al. (2016) (7) and Sajjad et al. (2021) (8), both of which were conducted in South Asia.

Balakrishnan and colleagues (2016) conducted a single-center randomized controlled trial in India, involving 300 patients with benign uterine pathology. The patients were equally assigned to undergo either vaginal hysterectomy or total abdominal hysterectomy (150 VH vs 150 AH) over 2 years. The results showed that the vaginal approach was associated with a significantly shorter operative time (37.07 minutes vs. 56.4 minutes for the AH group). Additionally, the vaginal surgery was linked to lower postoperative blood loss and pain, resulting in a faster recovery. The study concluded that, for patients with benign indications for hysterectomy, the vaginal approach is a viable option that offers quicker recovery and lower morbidity compared to the abdominal route. Nonetheless, further monitoring would have strengthened the findings. The authors acknowledged certain limitations, for instance, the lack of long-term postoperative outcome data and the omission of comparisons regarding the sexual implications of both surgical techniques, which is a crucial aspect to consider (7).

The focus on quality of life (QOL) is reflected in the study by Sajjad et al., published in 2021, which was conducted in Pakistan between April and December 2020. This RCT included 90 patients, randomized equally between the two techniques (45 VH vs. 45 AH). The authors aimed to compare quality of life following total hysterectomy by either the vaginal or abdominal route and reported satisfactory QOL in 84.4% of the VH group versus 64.4% in the AH group, a difference that was nearly statistically significant ($p = 0.051$) (8).

Considering that other authors, such as Kho KA (2019) (9) and Chen (2021) (10), have reported that the procedure itself improves patients' quality of life, the data presented by Sajjad et al. (2021) remain relevant despite the marginal significance of the p-value. These findings should be interpreted in light of the local context (single-center study) and the subjective nature of QOL reporting.

In light of the increasing prevalence of laparoscopic surgery and the continued training of surgeons, research has begun to focus on the benefits of minimally invasive surgery compared to traditional approaches. Regarding the comparison between vaginal hysterectomy and laparoscopy, we selected a European randomized trial from 2017 that analyzed 97 cases (from 100 patients selected). Laky R et al. emphasized that current guidelines favor the vaginal approach for benign conditions, and their conclusions support this stance. The study revealed that vaginal hysterectomy had a

significantly shorter operative time (55 ± 27 minutes vs. 95 ± 42 minutes for LH), although there were no statistically significant differences in pain, hospital stay duration, or postoperative complications (11). Once again, the markedly shorter duration of the vaginal approach is highlighted, nearly half that required for laparoscopy.

In the LH-AH group, numerous observational studies have analyzed parameters related to technique, surgeon, or patient characteristics. It is well known that the benefits for patients tend to favor laparoscopy; however, this approach also requires a longer learning curve for surgeons, specialized equipment for operating rooms, and is generally associated with higher costs. Over time, abdominal hysterectomy for benign pathology has become less favored, primarily due to slower recovery compared to other techniques, postoperative restrictions, and potential complications related to wound healing.

We selected two more recent randomized trials from the USA, Kho KA et al. (2019) (9) and Chen JS et al. (2021) (10), which examined quality of life in patients undergoing either abdominal or laparoscopic hysterectomy. Both studies found no significant long-term differences.

In the 2019 study by Kho KA, 94 post-hysterectomy patients were surveyed, randomized approximately equally between the two techniques, and followed at specific time points: 2 and 6 weeks, and 6 and 12 months, with a 95% completion rate. Regardless of surgical approach, quality of life showed an upward trend up to one year postoperatively. However, patients treated via laparoscopy reported significant improvements as early as the first few weeks following surgery. An essential parameter evaluated through questionnaires was sexual function, which proved to be significantly better after laparoscopic hysterectomy, even 12 months postoperatively, compared to the abdominal approach (9).

Another questionnaire-based RCT was conducted by Chen JS in 2021, including 91 patients, of whom 88 completed the study, with a maximum follow-up period of 12 months. The results indicated that hysterectomy, regardless of the surgical technique used, may have a therapeutic effect on patients' quality of life (10).

Quality of life standards for patients include not only the early resumption of activities under the same or improved conditions as preoperatively but also sexual function, as reflected in manifestations of the genitourinary syndrome. We selected a study that addresses these aspects, which are only sporadically discussed in the literature (Polat M et al., 2016), from Turkey. This study prospectively followed 292 patients, evenly assigned to two surgical techniques. The authors analyzed vaginal length, dyspareunia, and lower urinary tract function. Regarding vaginal length, it was found to be significantly greater following laparoscopic surgery. However, in patients who developed postoperative dyspareunia, no relevant differences in vaginal length were identified. Urinary tract function was evaluated using urodynamic parameters, such as pre- and postoperative maximum flow rate and bladder capacity, with results showing that these parameters increased after surgery regardless of the technique used. In conclusion, the authors emphasize the need for further research (12).

By synthesizing the data gathered from the current review, we observed that most studies favor the vaginal approach, followed by the laparoscopic one, in cases of benign gynecological pathology. Vaginal hysterectomy is associated with a shorter operative time and faster recovery and appears to offer superior benefits compared to the abdominal approach (AH). When technically feasible, VH should be the first option, as it allows quicker recovery and a shorter hospital stay while minimizing the risk of potential wound or abdominal wall healing complications. In situations where VH is not possible, the laparoscopic approach (LH) is preferable over AH due to its considerable advantages in terms of patient recovery. Even with its benefits, the procedure involves longer operative times and requires a more experienced surgical team. When comparing vaginal hysterectomy with laparoscopy, the outcomes were balanced: patient recovery time and satisfaction were similar, with only minimal advantages for laparoscopy.

Postoperative complications were rarely reported across all techniques. The methodological quality of the studies varied, though most were assessed as having a low risk of bias (*Fig. 2*). We considered both selection bias and reporting bias. Regarding patient randomization, we examined whether reliable participants were preferentially allocated to specific surgical approaches, for example, more complex cases to AH, younger patients to LH, or multiparous women to VH. Such allocations may have skewed the results, unfairly favoring one technique over another, which would constitute a form of selection bias.

Additionally, we evaluated the reporting process to determine whether reported short-term outcomes were consistent across all approaches

and whether patients were followed over more extended postoperative periods to ensure that conclusions were not misleading due to incomplete published data.

Although a comparative synthesis would have been ideal for highlighting the differences among the included studies, the heterogeneity of the reported parameters (such as operative time, blood loss, recovery, or quality of life) made difficult to obtain such a table. This variability reflects methodological and reporting differences across the analyzed studies. Through this descriptive review, we aim to provide an overall illustration (*Table 6*) of the factors that may guide the choice of each surgical approach.

The selected studies did not exhibit bias in the outcome reporting process, which supports the credibility and objectivity of the results obtained. We chose only randomized controlled trials, as they provide high-quality evidence that is difficult to match through other types of research.

Discussion

The results of the analyzed studies highlight that the choice of hysterectomy technique, (vaginal, abdominal, or laparoscopic) depends on multiple factors. Understanding these factors enables an individualized, evidence-based decision for each case.

The most relevant meta-analysis on this topic is the Cochrane review CD003677, "Surgical approach to hysterectomy for benign gynecological disease", which compares vaginal, laparoscopic, and abdominal approaches to hysterectomy in cases of benign gynecological pathology, with evidence updated through December 2022 (1).

Key conclusions from this review indicate that vaginal hysterectomy leads to a faster return to normal activities compared to the abdominal approach (24–38 days vs. 42 days). Similarly, patients who underwent laparoscopic hysterectomy experienced recovery times nearly equivalent to the vaginal technique (22–25 days), as compared to the abdominal approach. Nonetheless, a slightly increased risk of ureteral injury and higher costs associated with the laparoscopic approach should be noted. Still, these factors do not alter the main conclusion that VH and LH offer superior benefits over AH (1).

The results of the randomized controlled trials in our analysis align with the findings of this meta-analysis, particularly regarding the advantages related to recovery time.

Summarizing the advantages and disadvantages of each surgical approach based on the available data, we can conclude that: vaginal hysterectomy (VH) offers the fastest recovery but has limitations related to uterine size; laparoscopic hysterectomy (LH) provides better cosmetic outcomes and also a quick recovery, though it requires a longer learning curve and may involve higher costs; abdominal hysterectomy (AH) is safe, but should be reserved for complex cases or patients with previous surgeries.

A prospective, randomized study from 2003 compared all three techniques (VH, LH, and AH) in terms of operative time and blood loss, as assessed through hemoglobin monitoring. Sixty patients were divided equally among the three surgical approaches, and the results showed that VH had the shortest procedure time, while LH was associated with the least blood loss, making both

Table 6. Visual representation of the main parameters monitored (operative time, blood loss, pain, recovery or quality of life). The green boxes illustrate the hysterectomy techniques under comparison, while the shaded boxes show that these parameters were not followed or reported.

Studies / objectives	Shortest operative time (minutes)			Lowest complications (bleeding, pain)			Best recovery/QOL		
	LH	VH	AH	LH	VH	AH	LH	VH	AH
Nanavati, 2016		√		√	√		√	√	
Allam, 2015		√		√			√		
Balakrishnan, 2016		√			√			√	
Sajjad, 2021								√	
Laky, 2017		√		√	√		√	√	
Chen, 2021				√			√		
Kho, 2019				√			√		
Polat, 2016				√			√		

preferable to the abdominal approach (13). The study did not clearly specify the method of patient selection for each procedure, presenting a potential uncertainty in the randomization ROB-2 domain. However, the results may still be relevant in contexts such as anemic, comorbid, or elderly patients, where reduced operative time and minimal bleeding provide significant clinical benefits.

In the findings of this review, we also reported that Allam and colleagues (2015) demonstrated, through a triple-arm RCT, that VH had the shortest operative time (100 minutes) but the highest intraoperative blood loss, while LH yielded the best outcomes in terms of pain and length of hospital stay. AH ranked in the middle concerning operative time, findings that are consistent with meta-analytic data from the literature.

We will compare the techniques in groups to sequentially highlight the cost-effectiveness of each, as we did in the results section. In the past, multiple studies focused on comparing the vaginal and abdominal approaches; however, as laparoscopy gained prominence, attention shifted to minimally invasive surgery relative to traditional techniques.

In a 2014 prospective study including 313 patients, Chen et al. showed that vaginal hysterectomy ensured a shorter operative time, reduced blood loss, and faster postoperative recovery compared to the abdominal approach, reporting both efficacy and safety in favor of VH (14). Another study advocating for the vaginal approach is that of Chakraborty et al. (2011) from India, who clearly state that the surgeon's level of experience is a key factor in choosing the surgical route (15). Consistent with this, a 2013 study from Pakistan reported that the vaginal approach is a more efficient and safer option for benign gynecological conditions due to a lower incidence of complications compared to the abdominal technique (16). It is well recognized that South Asia has considerable expertise in vaginal surgery, which is reflected in the numerous large-cohort studies analyzing this technique.

Along the same lines, previous studies have reported similar findings. In 2003, Miskry and colleagues conducted a controlled, prospective, randomized, double-blind study across two centers involving 36 patients with benign gynecologic pathology to assess whether significant differences existed in hospitalization length and recovery between abdominal and vaginal hysterectomy in the absence of uterovaginal prolapse. The investigation reported shorter hospital stays and quicker recovery in patients who underwent VH, concluding that this technique should be considered the preferred option both in women with pelvic organ prolapse and those with unaffected pelvic anatomy (17).

In line with that study, Ribeiro Costa et al. (also in 2003) compared intra- and postoperative outcomes of vaginal versus abdominal hysterectomy in a randomized study involving 35 patients without genital prolapse. They highlighted the advantages of the vaginal approach: lower blood loss, less postoperative pain, and quicker recovery, although they found no significant differences in terms of complications or postoperative satisfaction. These findings support the use of vaginal hysterectomy as an effective alternative to the abdominal approach in most benign cases, regardless of pelvic anatomy (18).

In an Italian RCT from 2002, Benassi et al. compared VH with AH in cases of large fibroid uteri and found no significant procedural differences. A potential advantage of the vaginal approach was the shorter hospital stay (3 days for VH versus 4 for AH), which may translate into earlier recovery. The study concluded that vaginal hysterectomy is a viable alternative to abdominal hysterectomy, even in cases involving enlarged uteri (19).

When comparing vaginal hysterectomy with minimally invasive techniques such as laparoscopy, multiple studies have already analyzed various variables to justify the selection of one approach over the other.

Maintaining the same pelvic anatomy characteristics described in the studies by Miskry, 2003 (17), and Costa, 2003 (18), a prospective randomized controlled trial from 2009 compared vaginal and laparoscopic hysterectomy in a group of 60 patients without uterine prolapse, followed over 12 months. No statistically significant differences were observed between the groups during postoperative follow-up. While the laparoscopic approach was associated with a shorter hospital stay, less blood loss, and less postoperative pain compared to the vaginal technique, these differences were not significant (20).

From a cost perspective, VH remains the preferred option, especially in low-resource settings, as shown in a recent Egyptian study from 2022 involving 80 patients with benign pathology. This study compared VH and laparoscopy in terms of operative time, complications, postoperative pain, length of hospitalization, and cost. The other outcomes matched the findings of this review: LH

was associated with a longer operative time than VH, but it caused less postoperative pain (21). Similar results were reported by a recent 2023 meta-analysis that included 23 randomized controlled trials with 2,408 patients evenly assigned to either VH or LH (22).

Compared to vaginal hysterectomy, the laparoscopic approach offers benefits in terms of reduced postoperative pain, decreased need for analgesics, and shorter hospital stays, while maintaining similar perioperative outcomes, as reported by Ghezzi et al. in a 2010 randomized controlled trial (23). A London-based study presented similar findings, concluding that vaginal hysterectomy is, in most cases, the preferred option due to its efficiency. In contrast, the laparoscopic approach is associated with a longer operative time and does not provide significant additional benefits for most patients (24).

In a 2019 meta-analysis that included 18 studies with a total of 1,618 patients, Lee and colleagues examined the occurrence of complications following VH and LH, noting no differences in overall complication rates and confirming that both approaches are feasible (25). In conclusion, the benefits of both vaginal and laparoscopic techniques are well established. As highlighted in a study from India, vaginal hysterectomy is considered the gold standard in the era of minimally invasive surgery (26), while laparoscopy requires a higher level of surgical expertise. All of these findings align with the Cochrane meta-analysis CD003677, which supports the advantages of VH in terms of recovery and fewer complications (1).

Most recent studies compare minimally invasive surgery with the abdominal approach, and the results are unanimously favorable to laparoscopy.

In 2012, Nieboer and colleagues evaluated the quality of life in 59 patients through a randomized controlled trial using questionnaires. Four years after abdominal and laparoscopic hysterectomy, patients who underwent minimally invasive surgery reported a higher quality of life compared to those who had abdominal hysterectomy. The authors concluded that laparoscopy should be considered whenever feasible (27).

This research can be contextualized alongside several RCTs selected for this review, which demonstrate that both vaginal hysterectomy (VH) and laparoscopic hysterectomy (LH) offer postoperative quality-of-life benefits and highlight the importance of including quality-of-life scoring in surgical guidelines. Examples include Sajjad et al., 2021 (8), which identified a trend toward greater postoperative satisfaction among women undergoing VH compared to AH (84.4% vs. 64.4%, $p = 0.051$), approaching statistical significance; Kho KA et al., 2019 (9), which emphasized improvements in quality of life, physical activity, and sexual function after hysterectomy, regardless of the surgical approach, with notably faster and larger gains observed in laparoscopic procedures; Chen J.S. et al., 2021 (10), which found that hysterectomy positively affects patients' well-being regardless of the technique used, as long as the underlying condition is resolved.

Patients' quality of life is also reflected in sexual and urinary tract function. A multicenter randomized controlled trial (RCT) from Sri Lanka assessed vaginal, sexual, and urinary symptoms using two questionnaires and observed postoperative improvement in vaginal and urinary symptoms, regardless of the surgical technique used (28). These findings align with the study by Polat and colleagues in 2016, an RCT selected for this review specifically because it analyzes these rarely addressed parameters (12). Kotani et al., in a 2021 study, also observed that while laparoscopic surgery improves the immediate postoperative quality of life, no significant differences were found in the long term (29). Quality of life is often improved after a hysterectomy, regardless of the approach, as is the case after bariatric surgery, in which 77.78% of patients reported an enormous improvement and also improved sex life, reports a Romanian study (30).

A comparative study in Egypt involving a relatively small group of patients ($n = 50$) supports the safety and multiple benefits of laparoscopy over the abdominal approach (31), a conclusion confirmed by a Finnish study, also with 50 patients, which recommends laparoscopic hysterectomy whenever feasible due to its favorable clinical profile and reduced tissue trauma (32). Furthermore, when considering all three approaches, laparoscopic hysterectomy remains a viable and safe option even for patients with large uteri, serving as a valid alternative to abdominal surgery when the vaginal route is not possible, as stated by Seracchioli et al. in a prospective study (33).

Even before the 2000s, research had shown that the laparoscopic approach in benign conditions was associated with lower morbidity and a less intense physiological stress response compared to abdominal hysterectomy (34-35), findings that remain relevant today.

We conclude this section with a 2005 meta-

analysis by Johnson and collaborators, which included 27 trials and 3,643 patients comparing hysterectomy techniques for benign conditions. The most relevant conclusions are consistent with those of this narrative review: the vaginal approach is associated with faster recovery, though not significantly different from laparoscopy, while both techniques are superior to the abdominal route, which should be reserved for selected cases (36).

Tailored surgical management plays a crucial role, just as personalized medicine in oncology aims to adapt treatment dynamically to each patient's unique profile (37). The inclusion of large study populations treated by experienced surgeons across all surgical approaches strengthens the credibility of conclusions regarding both short and long-term outcomes. Therefore, we chose a recent 10-year period, assuming it would reflect a similar level of expertise, even for newer techniques like laparoscopy. This review focused exclusively on comparing surgical routes for hysterectomy (vaginal, laparoscopic, and abdominal) to summarize the benefits of each method.

Conclusions

In conclusion, the choice of the best surgical technique should be tailored to each patient, based on a thorough evaluation of the patient and the medical team's experience, to ensure the best functional postoperative outcomes.

Vaginal hysterectomy seems to offer benefits such as shorter operative time and quicker postoperative recovery, making it more suitable for patients with moderately sized uteri and clinics with limited resources. The laparoscopic approach provides better visualization of the surgical area and offers several benefits for patients, including improved aesthetics, a faster recovery, and an enhanced quality of life. However, it may lead to longer surgery times, require additional training for surgeons, specialized equipment, and higher costs. Abdominal hysterectomy offers undeniable benefits but should be considered a last resort for benign pathology, as it is the most invasive of the studied techniques.

Further studies, ideally prospective and randomized, are necessary to generate high-quality evidence and endorse standardizing the decision-making process. The choice of surgical approach should be discussed jointly with the patient, taking into account the benefits and risks in relation to their specific characteristics. The surgeon's level of experience is difficult to evaluate and seldom reported in the literature, yet it remains a significant factor that can influence both the decision and outcome of a procedure.

Integrating the findings of these studies into current clinical practice would be advantageous, and it is recommended that each clinic ensure the presence of surgeons skilled in all three surgical techniques.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Funding

This research received no external funding.

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