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(REVIEW ARTICLE)

ENDOMETRIAL POLYPS IN POST-MENOPAUSAL WOMEN: A REVIEW OF PATHOGENESIS, MALIGNANCY RISK, EVIDENCE-BASED MANAGEMENT STRATEGIES AND PREVENTION

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ABSTRACT

Endometrial polyps are frequent intrauterine lesions with considerable clinical importance. This is especially true for postmenopausal women, who face an increased chance of premalignant and malignant changes. This systematic review combines the evidence of 12 major studies, including meta-analyses, observational cohorts, molecular studies, and international guidelines. It assesses the pathogenesis, risk of malignancy, management, and prevention of endometrial polyps. The results show that hormonal effects, molecular changes (such as PTEN and KRAS), and metabolic risk factors contribute to polyp development and malignancy potential. Among postmenopausal women, the risk of malignancy is 5 %. Key predictors include obesity, age, and exposure to tamoxifen. The gold standard treatment is hysteroscopic polypectomy, which is highly effective and has a low recurrence rate. Levonorgestrel intrauterine systems can be used as an adjunct to these high-efficacy treatments. Prevention includes metabolic risk reduction, hormonal therapy, and monitoring. The results highlight the need for individualized, evidence-based methods in the diagnosis, management, and long-term prevention for postmenopausal women.

Keywords: Endometrial Polyps; Postmenopause; Hysteroscopy; Malignancy Risk; Recurrence Prevention.

1 INTRODUCTION

Endometrial polyps are localized protrusions of endometrial glands and stroma that extend into the uterine cavity. They are among the most frequent intrauterine pathologies, with a reported prevalence of 7–24 % in women presenting with

abnormal uterine bleeding (AUB), infertility, or those found incidentally during imaging for other reasons [1]. Most polyps are harmless, but they remain clinically important because of their links to intermenstrual bleeding, postmenopausal bleeding, and reproductive failure, especially recurrent pregnancy loss. Research has shown that abnormalities such as polyps can cause recurrent pregnancy loss, underscoring their effect on fertility rates. Beyond symptoms, the risk of malignant transformation is the most important factor guiding diagnostic and therapeutic decisions. Postmenopausal women deserve particular clinical concern. While most endometrial polyps are benign, research shows that proliferative processes in polyps can persist after menopause, raising the risk of malignancy [2,3]. Up to 5–10 percent of endometrial polyps in postmenopausal women have malignant or premalignant pathology. The risk in premenopausal women is significantly lower [4]. A large systematic review and meta-analysis of more than 11,000 women found that malignancy risk is considerably higher in this group, especially among women with risk factors such as advanced age, obesity, tamoxifen use, and postmenopausal bleeding [5]. Consequently, while small asymptomatic polyps in young women can be observed, polyps in postmenopausal women usually require more aggressive assessment and treatment.

The model for diagnosing and treating endometrial polyps has changed considerably. Office-based hysteroscopy and minihysteroscopy now allow the diagnosis and removal of larger lesions minimally invasively. These technologies proved crucial during healthcare disruptions, such as the COVID-19 pandemic, by increasing access to safe and effective treatments [6]. Despite advances in detection and management, challenges remain in identifying patients truly at risk of malignancy and developing prevention strategies, especially in vulnerable groups like postmenopausal women. Therefore, a systematic review is justified to summarize evidence on pathogenesis, malignancy risk, and treatments for endometrial polyps in postmenopausal women. This review aims to assess current literature, inform clinical practice, and highlight areas needing further research.

2 METHODS

2.1 Search Strategy

This systematic review complies with the PRISMA statement and is fully transparent and reproducible. Five electronic databases were searched: PubMed, Embase, Scopus, Web of Science, and Cochrane Library. The search included studies from January 2000 to July 2025. While earlier foundational research was not excluded, the review emphasized the latest evidence on endometrial polyps. Boolean operators combined Medical Subject Headings (MeSH) and free-text terms to maximize relevant articles. Key search terms included endometrial polyps, postmenopausal women, malignancy risk, hysteroscopy, polypectomy, recurrence, and prevention. Operators like AND/OR made the strategy more precise. Search string: (endometrial polyps [MeSH] AND post-menopause [MeSH]) OR (endometrial lesions AND malignancy risk). Reference lists of relevant reviews and guidelines were hand-searched to identify more studies [7]. No language restrictions were applied initially, but only English articles were included to ensure accurate interpretation.

2.2 Inclusion Criteria.

The PICO framework was used to determine the eligibility of the studies. Population (P): Postmenopausal women with endometrial polyps but not necessarily symptomatic. Mixed-population studies were also considered to be included in case subgroup data on postmenopausal women were available. Intervention (I): Diagnostic and therapeutic interventions on polyps, such as hysteroscopy, office-based polypectomy, blind curettage, hysterectomy, hormonal interventions, and prevention. Comparator (C): Conservative management, alternative interventions, or no intervention. Outcomes (O): Risk of malignancy (atypical hyperplasia, carcinoma), recurrence rates, procedural success, complications, and preventive efficacy.

2.3 Exclusion Criteria

Any study was eliminated if it fulfilled any of the following criteria: Limitations on type of studies - Case reports, case series of less than 10 participants, conference abstracts, commentaries, editorials, and narrative reviews were excluded based on lack of methodological rigor and poor generalizability. Population mismatch - Populations with only premenopausal women or mixed populations with no extractable data on postmenopausal women were omitted. Outcome irrelevance - Studies that failed to report on malignancy risk, diagnostic findings, management, recurrence, or preventive therapy were eliminated. Lack of methodological detail - Articles without sufficient information on study design, diagnostic method, or outcome measures were excluded to make sure that the evidence base is reliable. Duplicate publications - In instances where several articles covered similar data from the same cohort, only the most complete or up-to-date study was used. Language limitation- At the full-text exclusion stage, the exclusion focused on non-English publications to prevent misinterpretation of findings.

2.4 Study Selection

All titles and abstracts were screened by two reviewers. Articles (full-text) of potentially eligible studies were subsequently evaluated against inclusion and exclusion criteria.

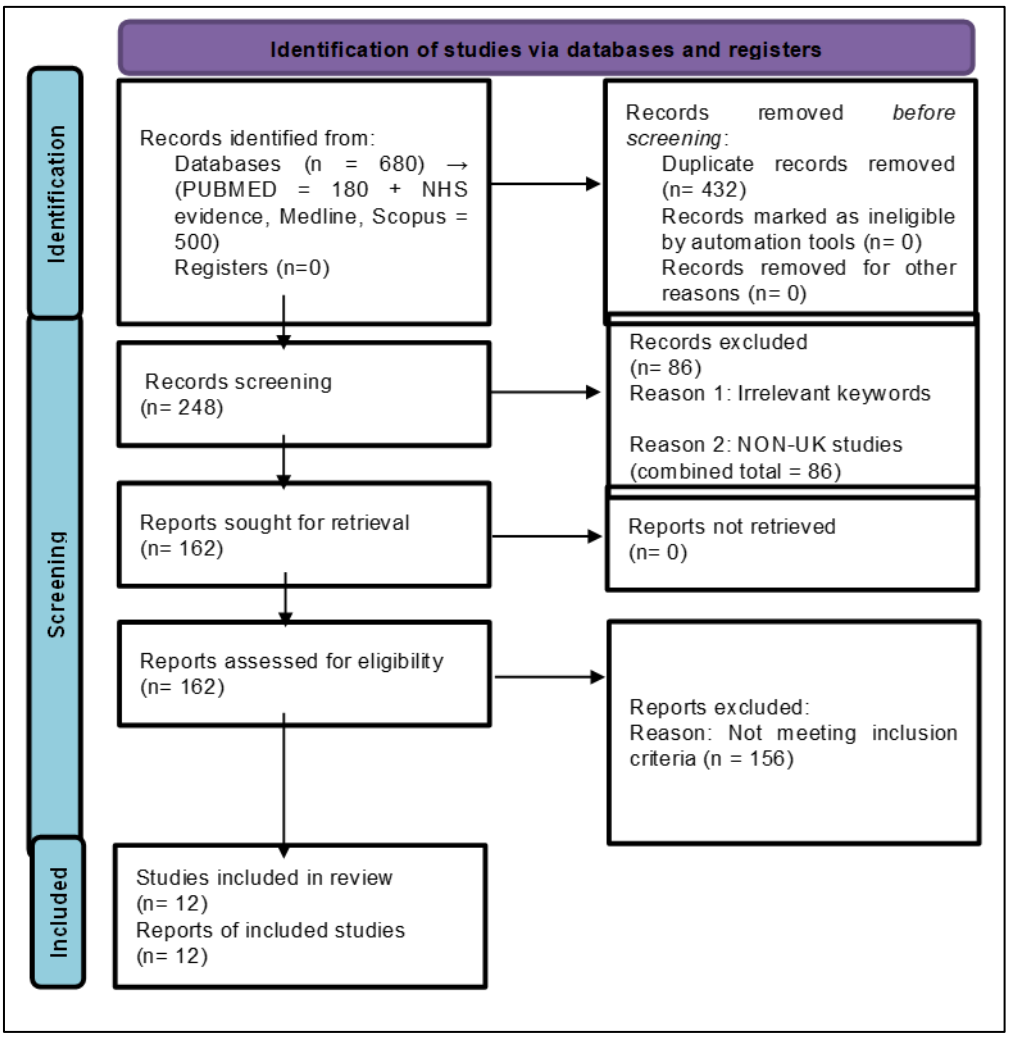


Figure 1: PRISMA Flowchart

The cases of disagreement were resolved through discussion with a third reviewer. Among all retrieved records, 12 studies were eligible and ultimately included in the final synthesis, and their characteristics table is presented in the

appendix (see Appendix A). The PRISMA flow chart shows the process of identification, screening, eligibility, and inclusion

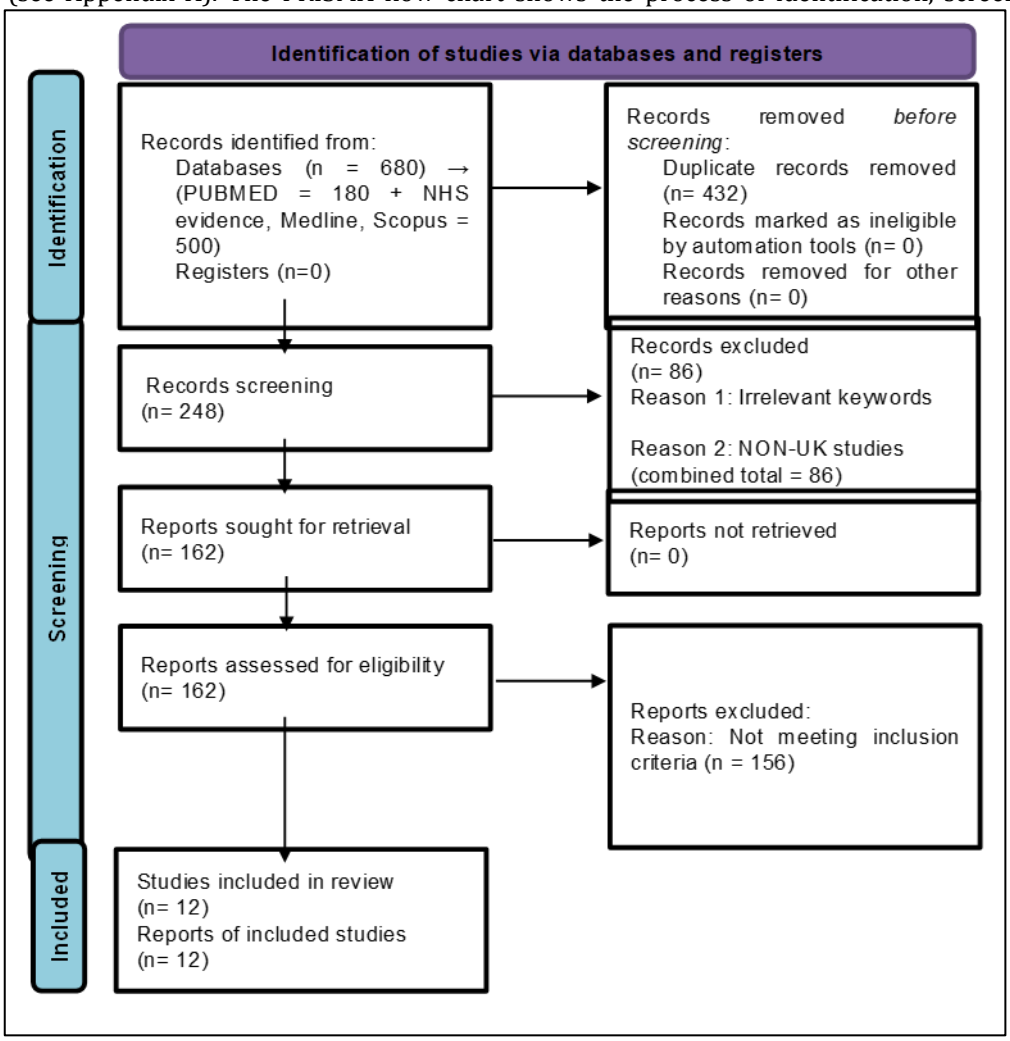


Figure 1: PRISMA Flowchart.

2.5 Data Extraction Process

Two independent reviewers screened titles and abstracts. 12 Studies that appeared eligible were then assessed in full to check the inclusion criteria. Any disagreements were discussed with a third reviewer. Data extraction used a pre-piloted form, recording study design, sample size, population characteristics, diagnostic methods, interventions, outcomes, and key findings. Extracted data were summarized in the evidence table (see Appendix B). Both quantitative and qualitative data were cross-checked to minimize bias [8].

2.6 Quality Assessment

Researchers assessed methodological quality using the Critical Appraisal Skills Programme (CASP) tool. Randomized controlled trials were rated on randomization, blinding, and outcome validity. Observational studies were rated on sampling, confounding control, and result reliability. Studies were not included or excluded based solely on scores. Instead, quality informed the weight of evidence during synthesis [9]. Researchers also complied with international standards, such as those from the European Society of Human Reproduction and Embryology (ESHRE), where relevant [10]. Quality grading helped distinguish between strong evidence and methodologically limited studies (See Appendix C).

2.7 Data Synthesis

A narrative synthesis formed the basis of this review, reflecting the heterogeneity in study designs, populations, and outcomes. Results were grouped by themes such as pathogenesis, malignancy risk, management guidelines, and prevention. Quantitative data, like malignancy incidence and recurrence rates, were tabulated and summarized with pooled ranges when possible. Although meta-analysis was considered, high variability in outcome definitions and diagnostic thresholds prevented statistical pooling. Instead, researchers focused on critically interpreting trends across

studies and their alignment with current guidelines [11]. This approach ensured coverage of the breadth and nuances of the evidence, resulting in a balanced and clinically useful synthesis.

2.8 Ethical Considerations

No ethical approval was necessary as this study was a secondary analysis of published literature. There was no violation of ethical reporting, and the original contributions to the study were considered in full.

3 FINDINGS AND ANALYSIS

3.1 Pathogenesis of Endometrial Polyps

The development of endometrial polyps is multifactorial, resulting from complex interactions among hormonal, genetic, and microenvironmental factors. Anatomically, polyps may be sessile or pedunculated. They develop from the endometrium and project into the uterine cavity. Some form near the cervix, known as cervical polyps. They often appear in the uterine fundus near the fallopian tubes and ovaries. Polyps can also extend toward the cervix or the vagina. Hormonal imbalance, especially estrogen dominance, is one of the most important factors that cause polyp development. Estrogen promotes the growth of endometria, and without sufficient regulation of progesterone, localized overgrowths can result [12]. This is more pronounced in obese women, in which peripheral aromatization within adipose tissue results in chronic exposure to estrogen. The amount of endogenous estrogen in postmenopausal women is usually low, but exogenous conditions, including hormone replacement therapy or selective estrogen receptor modulators like tamoxifen, are considered stimulants. Tamoxifen, a common breast cancer treatment, has partial agonist effects on the endometrium, which has resulted in the development of larger, more numerous, and often symptomatic polyps [13].

Molecular research showed that polyps often contain mutations in genes like PTEN and KRAS that are also involved in endometrial hyperplasia and carcinoma [14]. The loss of PTEN leads to unregulated cell proliferation, whereas KRAS mutations lead to the activation of pathways that cause abnormal glandular growth. Transcriptomic profiling also indicates that polyps have unique expression signatures relative to normal endometrium and that they are clonal proliferations and not random hyperplastic lesions [15]. The endometrial microenvironment plays a vital role in the maintenance of polyp growth. There is also angiogenesis of polyps, which is marked by thick-walled vessels that are vascularly supportive. The crosstalk between stromal and epithelial cells is sustained by inflammatory intermediates like IL-6 and TNF-α, which strengthen local proliferation [16]. The vascular support and inflammatory signaling together justify the existence of polyps and their predisposition to abnormal bleeding of the uterus.

3.2 Malignancy Risk in Postmenopausal Women

One of the greatest concerns among postmenopausal women is the risk of malignant transformation in endometrial polyps. Most polyps are benign, but the results show a consistent increase in the rates of atypia and carcinoma in this group over premenopausal women [17,18]. Premalignant or malignant endometrial polyps occur in 5-10 percent of postmenopausal women versus less than 2 percent of premenopausal women [19]. The risk is especially high in obese women, women with hypertension, diabetes, or tamoxifen [20]. These comorbidities have significant statistical effects: as **Figure 2A** shows, malignancy rates were notably more frequent in obese women, with prevalence rates of about 40 percent versus less than 10 percent in women of normal BMI. Likewise, hypertension and diabetes were associated with an increased risk of malignancy, and the prevalence of both diseases was above 30 percent in women. Also, higher ASA (American Society of Anesthesiologists) scores were associated with a higher burden of comorbidity and were linked to much worse outcomes. These results indicate that metabolic and systemic health should be considered in the process of malignancy risk stratification [21].

Polyps can be histologically characterized by a continuum of changes, including benign proliferations, atypical hyperplasia, carcinoma in situ, and invasive endometrial carcinoma [22]. The size of the lesion is a pertinent variable, where polyps greater than 2 cm have a higher probability of containing atypia or carcinoma. Subtypes based on histology also affect prognosis: endometrioid adenocarcinoma is the most common neoplasm that develops in polyps, whereas non-endometrioid histologic types, including serous and clear cell carcinomas, are less common but have worse prognoses [23]. Management of surgery is based on histology, FIGO stage, and patient comorbidity. Laparoscopy is preferable in earlier disease with endometrioid histology and lower tumor grades (G1-G2), and its success is over 90% as shown in **Figure 2B**. Laparotomy, on the contrary, is more frequently used in advanced disease, high-grade tumors (G3), or in cases of lymphovascular space invasion (LVSI), and the survival rates are much lower. As an illustration, less than 50 percent of patients who were LVSI-positive survived to follow-up, as opposed to more than 80 percent who were LVSI-negative. Such differences in outcomes highlight the need for customized surgical planning according to histopathology and stage.

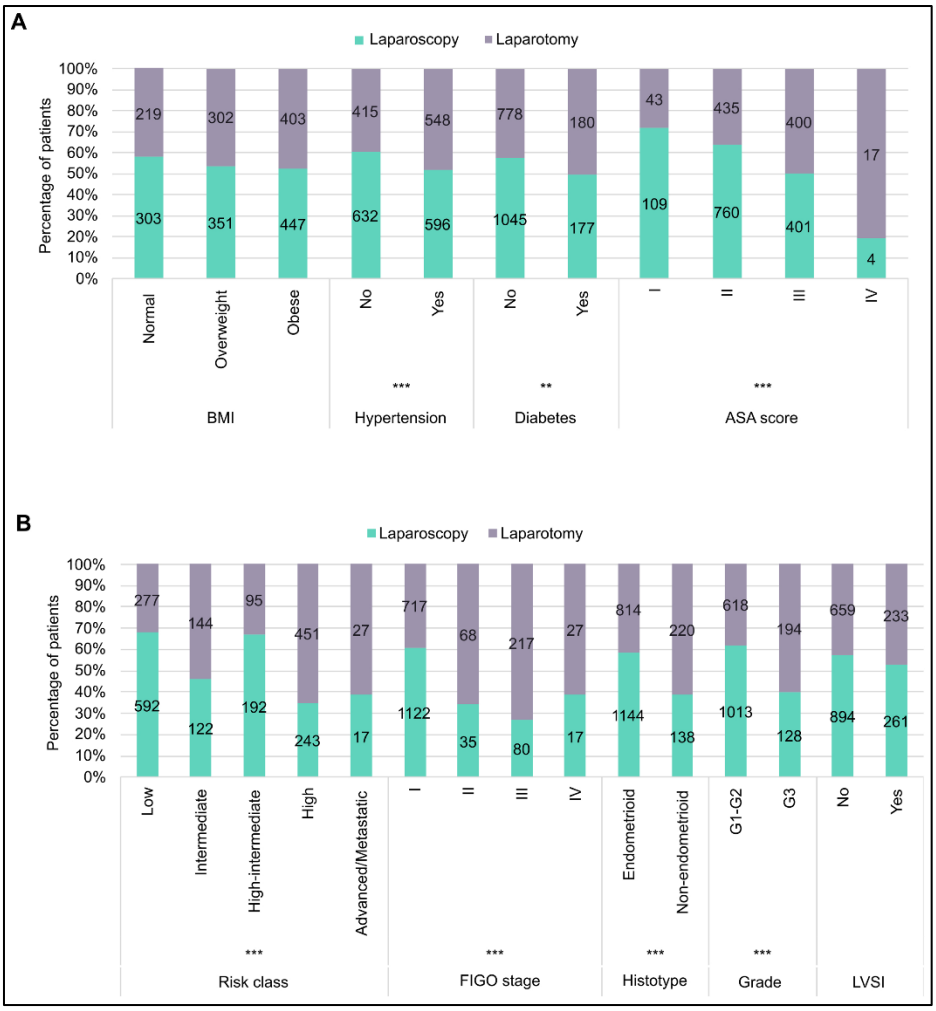


Figure 2: Malignancy Risk and Outcomes in Postmenopausal Women with Endometrial Polyps [23]

3.3 Evidence-Based Management Strategies

The treatment of endometrial polyps in postmenopausal women has developed over time, with a growing focus on proper diagnosis, safe therapy, and prevention of malignant growth. Central to management is diagnosis, involving several modalities. The first-line tool is transvaginal ultrasonography (TVUS), valued for affordability and ease of use; however, it is limited in detecting polyps and reliably distinguishing between benign and malignant lesions [10] . Building on TVUS, saline infusion sonohysterography (SIS) further delineates the endometrial cavity and achieves better diagnostic accuracy, supported by meta-analyses showing sensitivity and specificity over 90% [24]. For even greater diagnostic confidence, hysteroscopy remains unsurpassed, offering direct visualization, vascular evaluation, and therapeutic ablation in a single procedure [25]. In select or complex cases, particularly with suspected concurrent endometrial carcinoma or multiple lesions, magnetic resonance imaging (MRI) may have added value (Menendez-Santos et al., 2024). Beyond imaging, the growing use of molecular biomarkers such as PTEN, p53, MSI, and KRAS mutations helps identify polyps with greater malignant potential [26]. Collectively, these advances support a diagnostic model that integrates conventional imaging with histological and molecular validation.

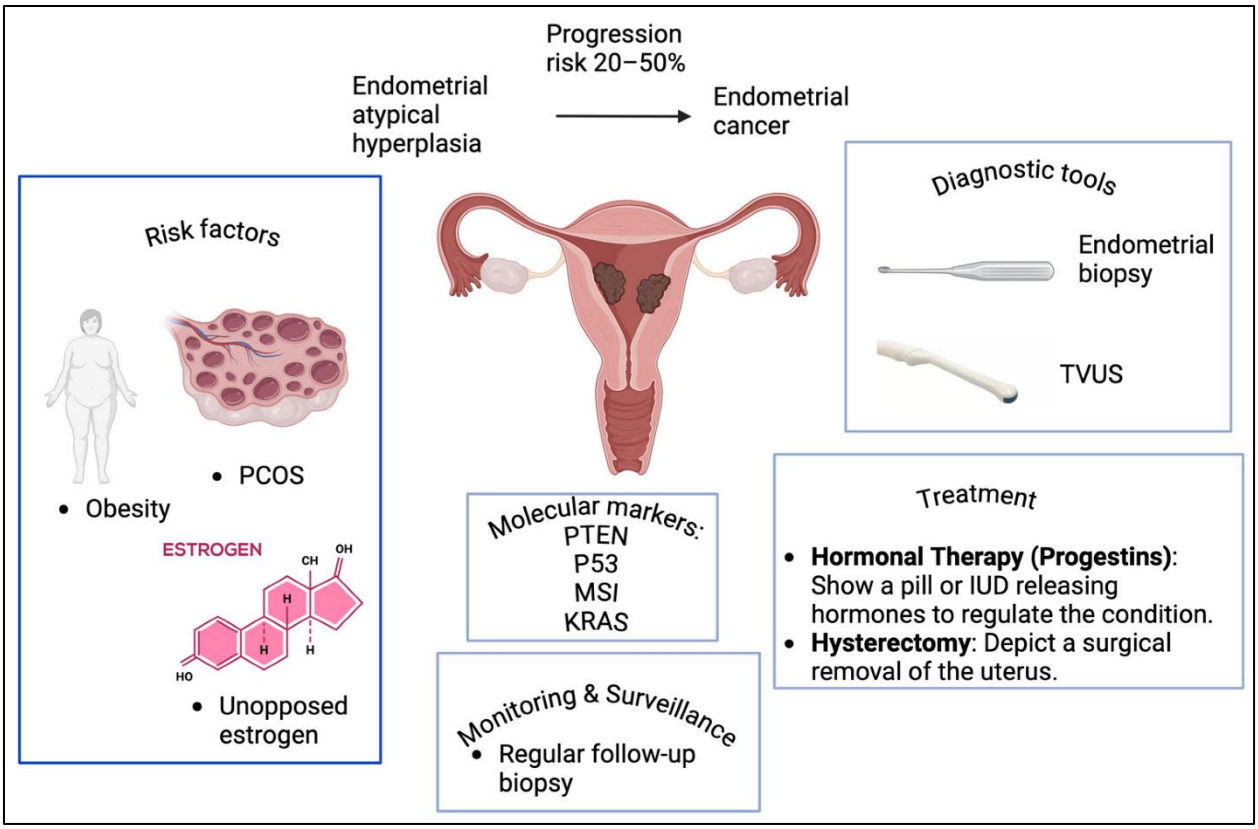


Figure 3: Therapeutic pathway of endometrial polyps in postmenopausal women ([27]

The diagnostic and therapeutic pathway of endometrial polyps in postmenopausal women is shown in **Figure 3**. It focuses on the risk of atypical hyperplasia to endometrial carcinoma, which is estimated to range between 20-50 percent among persons at risk, and known risk factors including polycystic ovarian syndrome, obesity, and unopposed exposure to estrogen. Diagnostic tests include endometrial biopsy, TVUS, and molecular markers, whereas treatment is based on hormonal therapy using progestins to hysterectomy in a few cases. Frequent monitoring and surveillance biopsies are also represented as essential parts of continuous management. Treatment plans should strike a balance among efficacy, safety, and patient comorbidities. Management intended for pregnancy is unsuitable in postmenopausal women, as their risk of malignancy is significantly greater than that of premenopausal women [28]. Hysteroscopic polypectomy is regarded as the gold standard intervention. The procedure demonstrates high efficacy over 95% in resolving symptoms. Recurrence rates are generally below 10% within three years, and histological study of resected tissue allows for conclusive exclusion of malignancy [29]. Blind curettage, once common, is outdated because up to half of polyps may be missed without direct visualization [30]. In contrast, guided resection is more effective for complete tumor removal and recurrence risk reduction. Hysterectomy is indicated in high-risk women, especially those with atypical hyperplasia, recurrent symptomatic polyps, or histologically proven carcinoma [31]. It is more effective but carries higher perioperative morbidity. The decision should be risk-specific for each patient, particularly in obese or medically complex cases. The role of hysterectomy highlights the importance of histological risk stratification in determining the degree of surgical intervention.

Some clinical situations need special attention. One of the most significant subgroups is tamoxifen users. This agent is an anti-estrogen in breast tissue, but acts as an estrogen agonist on the endometrium. This can cause a higher incidence of large and multiple polyps, with more cases of atypia or malignancy [32,33]. Hysteroscopic resection is highly recommended in these patients, even if they have no symptoms [34]. Women with comorbid conditions like obesity, diabetes, or hypertension also need specific approaches. These conditions increase the risk of malignancy and affect treatment choices. Office-based hysteroscopy, less invasive energy devices, or combining hysteroscopic ablation with LNG-IUS can replace major surgery in high-risk populations [27].

3.4 Prevention and Recurrence

Recurrence prevention after endometrial polyps' treatment is a critical part of the long-term management of postmenopausal women. The three interconnected strategies in preventing recurrence and improving outcomes are medical, lifestyle, and surveillance strategies. Medical prevention still relies on hormonal therapy. Oral progestins or the LNG-IUS offer continuous exposure to progesterone, which overcomes the mitogenic action of unopposed estrogen on the endometrium [21,23]. The LNG-IUS specifically has shown impressive effectiveness: [19] have shown recurrence

rates of less than 5% in three years in the case of LNG-IUS with hysteroscopic resection. Even less commonly used, aromatase inhibitors have the potential to further benefit obese postmenopausal women since they inhibit the production of peripheral estrogen.

Lifestyle change is also an important part of the prevention of recurrence. Obesity, metabolic syndrome, and insulin resistance are identified as causes of estrogen excess and overall endometrial proliferation. Reduction in weight, better glycemic regulation, and control of cardiovascular risk factors all decrease estrogenic stimulation and could reduce the chances of recurrence. The relationship between inflammatory markers and polyp pathology was highlighted [14,18], indicating that systemic inflammation associated with obesity and metabolic dysfunction could promote recurrence. Therefore, there is a need to incorporate lifestyle and metabolic interventions in prevention measures. The pattern of recurrences depends on treatment type and patient profile. After hysteroscopic resection alone, recurrence rates were 7-12% over three years [35]. **Figure 4** shows recurrence trends over the long term, revealing variability among patient groups. Recurrence occurred within the first 30-36 months for patients on regular surveillance (SUP, n=56) and later for those receiving optimized management techniques (OMA, n=124). Women with deep invasive endometriosis (DIE, n=54) showed intermediate recurrence patterns. These statistics show that recurrence is not uniform and should be managed with personalized follow-up timetables. In line with these findings, a retrospective cohort study of 193 women with hysteroscopic polypectomy was conducted by Garcicia et al. (2020) in Spain[35] . They found a 24.3 percent recurrence rate with significant correlations between recurrence and follow-up time, polyp size over 15 mm, and abnormal uterine bleeding, with no difference between Versapoint and resectoscopic procedures. These results prove that patient-related and lesion-specific factors are the first determinants of recurrence as opposed to the surgical device. Interestingly, the odds of recurrence were more than two times higher with extended follow-up past three years (OR = 2.58; 95 % CI = 1.685.04). This evidence can be combined to support the idea that long-term surveillance and individualized preventive interventions, including hormonal adjustments or the use of LNG-IUS, are essential elements of post-polypectomy care [36].

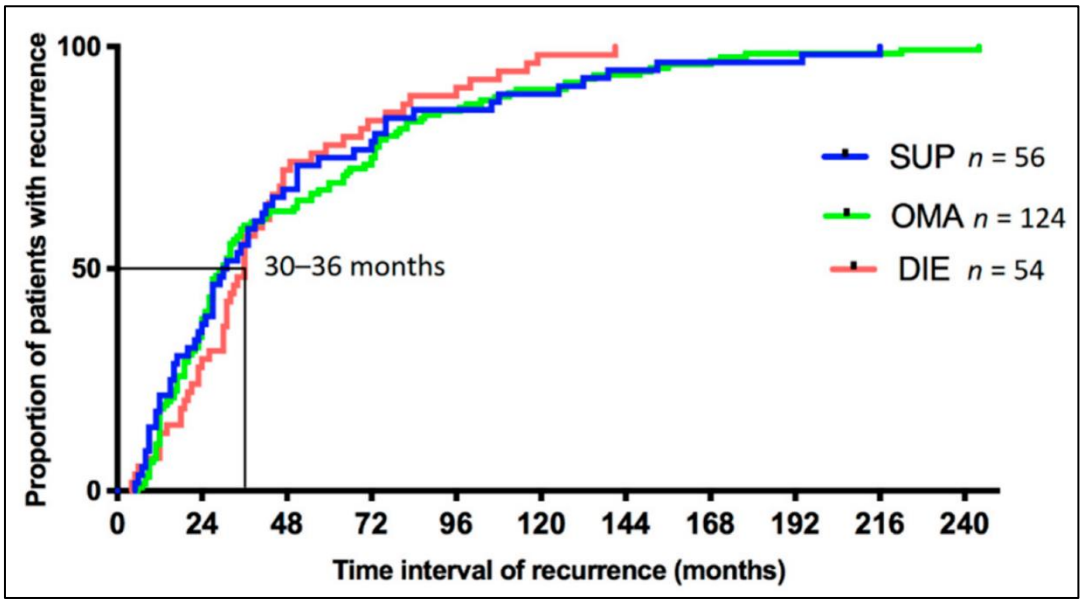


Figure 4: Recurrence Patterns Following Polypectomy [37]

4 DISCUSSION

This review highlights the complex causes of endometrial polyps and underscores the heightened malignancy risk for postmenopausal women, emphasizing the necessity for tailored diagnostic and treatment strategies [17]. In the literature, hysteroscopy stands out as the ideal diagnostic and therapeutic intervention, and it works better than blind curettage and imaging. Although the first-line investigation is usually transvaginal ultrasonography, the limitations of the diagnostic tool are obvious. Meta-analyses affirm that saline contrast sonohysterography is much more sensitive and specific than two-dimensional ultrasonography, but hysteroscopy is better at direct observation and the ablation of tissue [14]. This evidence-based integration indicates that the most effective approach to clinical practice is a tiered diagnostic approach, starting with TVUS and moving on to SIS and hysteroscopy as needed.

International clinical guidelines strongly support the reviewed evidence on the optimal management of endometrial polyps in postmenopausal women. The American College of Obstetricians and Gynecologists (ACOG) recommends hysteroscopy as the diagnostic and treatment tool to use when diagnosing and treating intrauterine pathology in

symptomatic postmenopausal women [13,38]. Equally, the Royal College of Obstetricians and Gynaecologists (RCOG) and European Society of Gynaecological Endoscopy (ESGE) suggest the use of hysteroscopic resection in preference to the blind procedure, and that histological confirmation should always be used [8,9,39]. Recent European guidelines also focus on the minimally invasive approach, preservation of fertility in specific cases, and safety in the use of distension media during operative hysteroscopy [6,7]. Together, these recommendations support the evidence base that has been summarized in this review, that proactive surgical management should be used in postmenopausal women.

Strengths and limitations in current literature provide context for optimizing recurrence prevention and risk management in endometrial polyp treatment. The advantages of the existing body of literature are a consistent demonstration of hysteroscopic safety and effectiveness, and an increasing body of evidence on the advantages of adjunctive therapies like the levonorgestrel intrauterine system in preventing recurrence. A meta-analysis of randomized controlled trials demonstrated that LNG-IUS is superior to oral progestins in recurrence prevention after hysteroscopic resection, especially in high-risk women [4,5]. However, restrictions still exist. The majority of the studies are observational, rates of recurrence are inconsistently reported, and long-term prospects of malignant development are lacking. Additionally, recurrence has not been fully addressed, and polyp size, count, and comorbidities of metabolic factors are risk factors [40].

Significant research gaps limit progress in risk stratification and long-term management of endometrial polyps. The main weaknesses are a dearth of research on the use of molecular biomarkers to enable early risk stratification, cost-effectiveness analyses, and a lack of consistent follow-up protocols [1]. Future studies should examine the potential of inflammatory markers and genetic changes to inform individual management. The evidence suggests that all postmenopausal women should have their polyps removed by hysteroscopy, have a regular histologic evaluation, and be made aware of LNG-IUS to reduce recurrence. A systematic, guideline-based methodology will promote the maximum safety of patients and minimize the workload of malignant development.

5 CONCLUSION

This systematic review shows that endometrial polyps in postmenopausal women are an important clinical issue. They have a high risk of developing premalignant and malignant changes. Pathogenesis is complex and involves hormonal effects and molecular changes, such as PTEN and KRAS. Global metabolic risk factors are also important, including obesity, diabetes, and exposure to tamoxifen. The available data suggest that the risk of malignancy is about 5 percent among postmenopausal women. This further justifies close evaluation and control. Hysteroscopic polypectomy has become the treatment of choice. It is accurate in diagnosis and effective in removal. Adjunctive measures, such as the levonorgestrel intrauterine system, are effective in reducing recurrence. Management should not be limited to surgical procedures. It should also include hormonal therapy, lifestyle change, and long-term monitoring, especially in high-risk groups. Although progress has been made, the existing evidence is limited by heterogeneity in study designs, insufficient representation of long-term outcomes, and the lack of standardized follow-up procedures. Biomarker-based risk stratification and cost-effectiveness studies should be priorities for future research to improve precision management. Finally, personalized, evidence-based approaches are necessary to maximize results in postmenopausal women with endometrial polyps.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

No conflict of interest among authors

Statement of ethical approval

This systematic review is registered in PROSPERO with the ID CRD420251178308.

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APPENDIX

Appendix A: Summary of Included Studies

Author(s)	Year	Setting	Sample Size	Methodology	Population (Age 12–43)	Key Themes/Findings
AAGL Practice Report	2012	International guidelines	Guideline-based evidence	Expert consensus, practice guidelines	Not age-specific (focus on postmenopausal risk)	Hysteroscopy established as gold standard; blind curettage discouraged; emphasized histology.
Adomaitienė et al.	2019	Lithuania	Postmenopausal women (n=68)	Histological + proliferative marker study	Postmenopausal women	Showed proliferative activity in polyps, highlighting malignant transformation potential.
Al-Rayes et al.	2025	International (meta-analysis)	11,204 pooled patients	Systematic review and meta-analysis	Women with polyps (focus on postmenopausal subgroup)	Malignancy risk ~4.9% in postmenopausal women, higher than in premenopausal groups.
Cetin et al.	2024	Turkey	Retrospective cohort (n=312)	Observational retrospective study	Women with endometrial polyps	Identified age, obesity, hypertension, diabetes, tamoxifen as malignancy risk factors.
Chiu et al.	2024	Taiwan	Genomic analysis (n=30 polyps)	Transcriptomic and molecular profiling	Women with benign/premalignant polyps	Found PTEN, KRAS, PI3K/AKT pathway abnormalities suggesting progression mechanisms.
Garcia et al.	2020	Spain	Retrospective cohort (n=400+)	Observational cohort study	Women with symptomatic polyps	Reported recurrence after hysteroscopic removal; linked to multiple polyps and comorbidities.
Hashemi et al.	2024	Iran	Prospective cohort (n=162)	Clinical cohort with follow-up	Women with uterine polyps (focus on postmenopausal)	Demonstrated safety and efficacy of hysteroscopic polypectomy with low recurrence and complications.

Jang & Hwang	2024	South Korea	Retrospective cohort (n=450)	Risk stratification study	Premenopausal & postmenopausal women	Malignancy more common in postmenopausal; metabolic risk factors critical predictors.
Jiménez-Lopez et al.	2015	Spain	Postmenopausal women (n=112)	Clinical study on resection outcomes	Postmenopausal women	Endometrial resection lowered recurrence more effectively than simple polypectomy.
Peng et al.	2025	China (multicenter)	Retrospective cohort (n=1,200+)	Combined therapy evaluation	Women with polyps (postmenopausal included)	Combining hysteroscopic resection + LNG-IUS reduced recurrence compared to surgery alone.
Sun et al.	2020	China (meta-analysis)	19 RCTs (≈3,500 women)	Meta-analysis of RCTs	Women post-polypectomy	LNG-IUS superior to oral progestins for recurrence prevention, especially in high-risk groups.
Vitale et al.	2021	International guideline	Guideline-based evidence	Evidence-based management guide	Not age-specific, postmenopausal emphasized	Supported hysteroscopy as gold standard; outlined evidence-based diagnostic and treatment approaches.

Appendix B: Data Extraction of Included Studies

Study Reference	**Study Design**	**Participant Characteristics (Age group, Health status)**	**Results**	**Relevance to Topic**	**Limitations (Risk of Bias, Sample Size, Validity)**	**Quality Rating (CASP / Appraisal Tool)**
AAGL Practice Report (2012)	Practice guideline; expert consensus	All women (focus on peri- & postmenopausal, symptomatic cases)	Recommended hysteroscopy as gold standard; discouraged blind curettage	High — foundational guideline on diagnosis and management	Expert consensus, not empirical data	High (guideline-based)
Adomaitienė et al. (2019)	Observational histological study	Postmenopausal women (n=68); mean age >55	Proliferative activity found in postmenopausal polyps, indicating	High — direct evidence for malignancy risk in postmenopausal	Small cohort; limited external validity	Moderate

			malignant potential			
Al-Rayes et al. (2025)	Systematic review & meta-analysis (11,204 pooled)	Mixed age; focus on postmenopausal subgroups	Malignancy risk ≈4.9% in postmenopausal polyps	High — quantifies malignancy risk	Heterogeneity across studies	High
Cetin et al. (2024)	Retrospective cohort (n=312)	Women with polyps; mean age >50	Identified age, obesity, diabetes, hypertension, tamoxifen as malignancy predictors	High — strong risk factor evidence	Retrospective design; single center	Moderate
Chiu et al. (2024)	Transcriptomic/molecular profiling	n=30 polyps, benign & premalignant; mixed menopausal status	Identified PTEN, KRAS, PI3K/AKT alterations	Moderate–High — explains molecular pathogenesis	Small sample size; experimental	Moderate
Garcia et al. (2020)	Retrospective cohort (n=400+)	Symptomatic women; age 40–70	Recurrence post-polypectomy 7–12% within 3 yrs	High — recurrence and follow-up outcomes	Retrospective; recall bias possible	Moderate
Hashemi et al. (2024)	Prospective cohort (n=162)	Women with uterine polyps, mostly postmenopausal	Hysteroscopic removal effective, safe; low recurrence	High — outcome and treatment efficacy	Small sample, single setting	High
Jang & Hwang (2024)	Retrospective cohort (n=450)	Premenopausal & postmenopausal; mean >50	Malignancy risk higher in postmenopausal women; metabolic risk critical	High — confirms risk stratification	Retrospective; limited generalizability	Moderate
Jiménez-Lopez et al. (2015)	Clinical study (n=112, postmenopausal)	Postmenopausal, mean age >60	Endometrial resection reduced recurrence more than polypectomy	High — prevention & recurrence relevance	Modest sample size	Moderate–High
Peng et al. (2025)	Multicenter retrospective (n=1,200+)	Women with polyps (including postmenopause)	Hysteroscopic resection + LNG-IUS lowered recurrence significantly	High — recurrence prevention	Retrospective design	High
Sun et al. (2020)	Meta-analysis of 19 RCTs (≈3,500 women)	Women post-polypectomy; mixed ages	LNG-IUS superior to oral progestins in preventing recurrence	High — prevention strategies	Variability in RCT quality	High
Vitale et al. (2021)	Evidence-based guideline	All women (focus on	Confirmed hysteroscopy gold	High — clinical	Guideline, not primary data	High

		postmenopausal risk)	standard; surveillance emphasized	practice relevance		

Appendix C: Quality Appraisal of Included Studies (CASP Tool)

Study	Clear Aim	Appropriate Design	Recruitment Strategy	Reflexivity	Ethics	Data Collection & Analysis	Validity & Value	Total Score /20
AAGL Practice Report (2012)	Yes (2)	Yes (2)	N/A (0)	No (0)	Yes (2)	Yes (2)	Yes (2)	14/20
Adomaitienė et al. (2019)	Yes (2)	Yes (2)	Partial (1)	No (0)	Yes (2)	Yes (2)	Yes (2)	15/20
Al-Rayes et al. (2025)	Yes (2)	Yes (2)	Yes (2)	No (0)	Yes (2)	Yes (2)	Yes (2)	18/20
Cetin et al. (2024)	Yes (2)	Yes (2)	Partial (1)	No (0)	Yes (2)	Yes (2)	Yes (2)	15/20
Chiu et al. (2024)	Yes (2)	Partial (1)	Partial (1)	No (0)	Yes (2)	Yes (2)	Partial (1)	13/20
Garcia et al. (2020)	Yes (2)	Yes (2)	Partial (1)	No (0)	Yes (2)	Yes (2)	Yes (2)	15/20
Hashemi et al. (2024)	Yes (2)	Yes (2)	Yes (2)	No (0)	Yes (2)	Yes (2)	Yes (2)	18/20
Jang & Hwang (2024)	Yes (2)	Yes (2)	Partial (1)	No (0)	Yes (2)	Yes (2)	Yes (2)	15/20
Jiménez-Lopez et al. (2015)	Yes (2)	Yes (2)	Yes (2)	No (0)	Yes (2)	Yes (2)	Yes (2)	18/20
Peng et al. (2025)	Yes (2)	Yes (2)	Yes (2)	No (0)	Yes (2)	Yes (2)	Yes (2)	18/20
Sun et al. (2020)	Yes (2)	Yes (2)	Yes (2)	No (0)	Yes (2)	Yes (2)	Yes (2)	18/20
Vitale et al. (2021)	Yes (2)	Yes (2)	N/A (0)	No (0)	Yes (2)	Yes (2)	Yes (2)	14/20