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Research Article

Efficacy and Safety of Hysteroscopic Polypectomy in the Management of Abnormal Uterine Bleeding

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ABSTRACT

Background: Abnormal uterine bleeding (AUB) remains one of the most frequent gynecological complaints affecting women of reproductive and perimenopausal age worldwide. It accounts for up to 30–40% of outpatient gynecologic consultations and represents a major cause of anemia, reduced quality of life, and unnecessary hysterectomies.

Methods: In a prospective cohort of 156 patients with NIDCM, serial NT-proBNP measurements and transthoracic echocardiography were performed at baseline, 12 months, and 24 months. Patients were categorized according to NT-proBNP trajectory: Responders (≥30% reduction), Stable (<30% change), and non-responders (≥30% increase). Echocardiographic indices included left ventricular ejection fraction (LVEF), global longitudinal strain (GLS), and left atrial volume index (LAVI). The composite endpoint was all-cause mortality or heart failure (HF) hospitalization. Kaplan–Meier analysis, multivariable Cox regression, and receiver operating characteristic (ROC) analyses were used to evaluate predictive value.

Results: This prospective observational study was conducted between January 2021 and December 2023 at the Department of Gynecology, Hospital das Clínicas, University of São Paulo (USP). A total of 210 women aged 18–55 years with AUB and sonographic evidence of endometrial polyps underwent hysteroscopic removal using mechanical scissors, bipolar resectoscope, or morcellation systems. Pre- and postoperative menstrual blood loss was assessed using the Pictorial Blood Loss

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Assessment Chart (PBAC). Surgical efficacy, complications, and histopathologic outcomes were analyzed. Follow-up visits occurred at 3, 6, and 12 months. Data were evaluated using Student's *t*, χ^2, and logistic regression tests ($p < 0.05$ considered significant).

Conclusions: Hysteroscopic polypectomy is a highly effective, safe, and fertility-preserving procedure for treating AUB caused by endometrial polyps. It achieves rapid symptom relief, low recurrence, and minimal complications while ensuring complete lesion removal and histologic confirmation. These findings support hysteroscopic polypectomy as the first-line standard of care for AUB in both public and private Brazilian healthcare systems.

Keywords: Abnormal Uterine Bleeding; Endometrial Polyp; Hysteroscopic Polypectomy; Minimally Invasive Gynecology; Recurrence

INTRODUCTION

Abnormal uterine bleeding (AUB) remains one of the most frequent gynecological complaints affecting women of reproductive and perimenopausal age worldwide. It accounts for up to 30–40% of outpatient gynecologic consultations and represents a major cause of anemia, reduced quality of life, and unnecessary hysterectomies [1,2]. AUB encompasses any variation in the regularity, frequency, duration, or volume of menstrual flow and may arise from structural or non-structural etiologies as defined by the FIGO PALM-COEIN classification system—Polyp, Adenomyosis, Leiomyoma, Malignancy and hyperplasia (PALM) versus Coagulopathy, Ovulatory dysfunction, Endometrial causes, Iatrogenic, and Not yet classified (COEIN) [3].

Among these causes, endometrial polyps (EPs) are particularly significant. They are localized overgrowths of endometrial glands and stroma, covered by epithelium, projecting into the uterine cavity, and frequently attached by a vascular pedicle [4]. The prevalence of endometrial polyps among women with AUB ranges from 10% to 40%, increasing with age and hormonal exposure [5]. Polyps are often associated with intermenstrual bleeding, menorrhagia, and infertility, though they may also be discovered incidentally during evaluation for other conditions [6].

Historically, the management of endometrial polyps was performed through blind dilatation and curettage (D&C) or polypectomy using curettes or forceps. However, blind techniques have been criticized for their limited diagnostic accuracy and incomplete removal, with recurrence rates approaching 15–25% [7].

The introduction of hysteroscopy has revolutionized intrauterine diagnosis and treatment, allowing direct visualization and targeted excision of focal lesions under magnification.

Hysteroscopic polypectomy provides both diagnostic and therapeutic benefits—it allows confirmation of the lesion's nature, ensures complete removal under vision, and enables histopathologic evaluation to exclude hyperplasia or malignancy [8]. It can be performed in an outpatient setting using mechanical scissors, bipolar resectoscopes, or tissue removal systems (morcellators), depending on lesion size and location [9].

The minimally invasive nature of hysteroscopy has led to shorter hospital stays, faster recovery, reduced pain, and improved patient satisfaction compared to blind curettage or hysterectomy [10].

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Moreover, current evidence supports the role of hysteroscopic resection not only in symptom control but also in improving fertility outcomes by restoring normal endometrial architecture and implantation potential [11,12].

The exact mechanism by which endometrial polyps contribute to AUB remains multifactorial. Structural disruption of the endometrial surface, abnormal vascular architecture, and local inflammatory and angiogenic changes have been implicated [13]. Polyp tissue demonstrates overexpression of vascular endothelial growth factor (VEGF) and matrix metalloproteinases (MMP-2, MMP-9), promoting fragility and irregular shedding during the menstrual cycle [14]. In addition, local hormonal imbalances—particularly unopposed estrogen stimulation and progesterone receptor downregulation—create an environment conducive to polyp growth [15].

This pathophysiological complexity underscores the necessity for complete lesion removal and histologic confirmation. Incomplete excision or residual tissue may perpetuate abnormal bleeding or lead to recurrence. Thus, hysteroscopic polypectomy, by ensuring direct visualization of the uterine cavity, offers a superior approach to both symptom resolution and recurrence prevention.

Numerous studies have demonstrated high efficacy of hysteroscopic polypectomy in resolving AUB. Reported rates of symptom improvement range from 70% to 95%, depending on patient selection, technique, and follow-up duration. In randomized controlled trials comparing hysteroscopic polypectomy with blind curettage, the hysteroscopic group showed significantly higher rates of complete removal and lower recurrence at 12 months [16].

The use of bipolar electrosurgical resection and mechanical morcellation systems (e.g., MyoSure®, Truclear®) has further improved the precision and safety of intrauterine tissue removal. These systems enable continuous fluid management, better visualization, and reduced risk of uterine perforation or fluid overload. Importantly, hysteroscopic polypectomy preserves uterine integrity and fertility, making it the preferred treatment for women desiring future conception [17].

While hysteroscopy is considered a safe procedure, potential complications include uterine perforation, bleeding, infection, cervical laceration, and fluid overload from distension media. The reported overall complication rate is low (0.2–1.6%). The most common intraoperative issue is vasovagal reaction or cervical difficulty during entry, particularly in nulliparous women. Postoperative complications are rare, and the recurrence of polyps after complete resection occurs in 5–10% of cases, typically related to residual base tissue or hormonal predisposition.

The choice of energy source and the operator's experience significantly influence safety outcomes. Bipolar energy allows the use of isotonic saline as distension medium, reducing the risk of hyponatremia and fluid absorption complications compared to monopolar systems. The use of smaller-diameter hysteroscopes (≤5 mm) and office-based techniques has also minimized anesthesia-related risks.

Although most endometrial polyps are benign, the risk of atypical hyperplasia or malignancy cannot be ignored, particularly in postmenopausal women or those with abnormal bleeding [18]. Reported rates of atypical hyperplasia within polyps range from 0.5% to 4.8%, and endometrial carcinoma is found in approximately 0.8–3% of cases.

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Risk factors include age >45 years, obesity, tamoxifen use, and postmenopausal status. Therefore, all resected specimens must undergo histopathologic examination, which remains the gold standard for definitive diagnosis and risk stratification [19].

In this context, hysteroscopic removal not only achieves symptom control but also serves a diagnostic role, identifying premalignant or malignant changes early and guiding appropriate management [20]. This dual benefit further supports hysteroscopy as the procedure of choice for endometrial polyps presenting with AUB.

Despite robust international evidence, regional variations in outcomes, technique, and accessibility persist, particularly in developing countries where equipment availability and operator training differ [21]. Data from North Africa and the Mediterranean region remain limited, and few prospective studies have systematically evaluated both the efficacy and safety of hysteroscopic polypectomy in AUB within these healthcare contexts [22].

Given the growing emphasis on minimally invasive gynecologic surgery and fertility preservation, it is crucial to validate the success rate, recurrence risk, and complication profile of hysteroscopic polypectomy in real-world clinical practice. Moreover, understanding predictors of recurrence—such as polyp size, multiplicity, and hormonal status—could help refine patient selection and postoperative follow-up strategies [23].

Study Aim

The present study aims to evaluate the efficacy and safety of hysteroscopic polypectomy in the management of women presenting with abnormal uterine bleeding.

The specific objectives are to:

1. Assess the rate of symptom improvement and resolution following hysteroscopic polypectomy.
2. Evaluate perioperative complications and postoperative recovery outcomes.
3. Determine recurrence rates during follow-up and identify associated risk factors.
4. Correlate clinical outcomes with histopathologic findings of the resected polyps.

By providing contemporary data from our institution, this study seeks to contribute to the global evidence base supporting hysteroscopic management of AUB and to promote the safe, effective implementation of minimally invasive gynecologic surgery within regional healthcare systems.

METHODS

Study Design and Setting

This study was designed as a prospective, observational, single-arm clinical study conducted at the Department of Gynecology and Minimally Invasive Surgery, Hospital das Clínicas, University of São Paulo (USP), São Paulo, Brazil, between January 2021 and December 2023. The study aimed to evaluate the efficacy and safety of hysteroscopic polypectomy in women presenting with abnormal uterine bleeding (AUB) due to suspected endometrial polyps.

All procedures were performed in the Ambulatory Surgical Unit for Endoscopic Gynecology, equipped with high-definition video hysteroscopic systems and facilities for both office-based and operating room procedures. The study was conducted in accordance with the Declaration of

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Helsinki (2013 revision) and Brazilian regulatory guidelines, including Resolution No. 466/12 of the National Health Council (CNS) governing research on human subjects. Ethical approval was obtained from the Institutional Research Ethics Committee of Hospital das Clínicas, University of São Paulo (CEP-HC/FMUSP), Protocol No. 4.175.332, and all participants provided written informed consent prior to inclusion.

Study Population

Inclusion Criteria

Women aged 18–55 years presenting with abnormal uterine bleeding—menorrhagia, metrorrhagia, intermenstrual bleeding, or postmenstrual spotting—were eligible for inclusion if they met all of the following criteria:

1. Evidence of an intrauterine focal lesion compatible with endometrial polyp on transvaginal ultrasound (TVUS) or saline infusion sonohysterography (SIS).
2. Normal coagulation profile and hemoglobin ≥10 g/dL.
3. No contraindication to hysteroscopic surgery or anesthesia.
4. Willingness to participate and comply with follow-up assessments.

Exclusion Criteria

Patients were excluded in the presence of:

1. Active pelvic infection or cervicitis.
2. Pregnancy or postpartum state (<6 months).
3. Coagulopathies or chronic anticoagulant therapy.
4. Endometrial carcinoma, atypical hyperplasia, or submucosal myoma >2 cm.
5. Previous endometrial ablation or uterine malformation.

Preoperative Evaluation

All patients underwent a comprehensive clinical and gynecologic assessment including detailed menstrual history, bimanual examination, cervical cytology, and laboratory investigations (CBC, coagulation profile, fasting glucose, and β-hCG when indicated).

Endometrial evaluation was initially performed using transvaginal ultrasonography (GE Voluson E8®, USA). In cases of diagnostic uncertainty, saline infusion sonohysterography was utilized to confirm the presence, size, and location of the polypoid lesion.

Endometrial thickness was recorded, and polyps were categorized as sessile or pedunculated based on imaging characteristics.

Patients were scheduled for hysteroscopy during the early proliferative phase (day 6–10 of the menstrual cycle) to optimize visualization and minimize bleeding interference.

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Operative Technique

Instrumentation

All procedures were performed using a rigid hysteroscope (Karl Storz® 4 mm, 30° lens) connected to a high-definition video camera system and continuous-flow sheath.

Uterine distension was achieved with isotonic saline using an automated pressure-controlled irrigation system (Endomat®), maintaining an intrauterine pressure of 80–100 mmHg and flow rate of 250–350 mL/min.

Mechanical and electrosurgical instruments included:

- 5-Fr hysteroscopic scissors or grasping forceps for small, pedunculated polyps.
- Bipolar resectoscope (Versapoint® or Karl Storz AUTOCON® II) for larger sessile or multiple polyps.
- In selected cases, a mechanical tissue removal system (MyoSure® Reach, Hologic) was used for efficient resection and morcellation.

Procedure

Patients were placed in the lithotomy position under paracervical block with sedation or spinal anesthesia depending on lesion size and patient preference.

After cervical dilation with Hegar dilators (if required), the hysteroscope was gently introduced under direct visualization.

Lesion size (maximum diameter in mm), morphology (sessile or pedunculated), and location (fundal, anterior, posterior, lateral wall, or isthmic) were recorded.

Each polyp was resected at its base, ensuring removal of the vascular pedicle. The cavity was re-inspected to confirm complete excision and hemostasis.

All specimens were retrieved, labeled, and sent for histopathologic examination in 10% formalin.

Postoperative Care and Follow-Up

Patients were discharged on the same day following observation for two hours post-procedure. Oral analgesics (paracetamol 500 mg or ibuprofen 400 mg every 8 hours as needed) were prescribed for 24–48 hours.

Patients were advised to avoid sexual intercourse and vaginal douching for seven days postoperatively.

Follow-up visits were scheduled at:

- 2 weeks: postoperative assessment and review of histopathology.
- 3 months: evaluation of bleeding pattern improvement and menstrual regularity.
- 6 and 12 months: clinical reassessment and repeat transvaginal ultrasonography to detect recurrence.

Symptom improvement was defined as normalization of the menstrual pattern or a ≥50% reduction in bleeding volume measured using the Pictorial Blood Loss Assessment Chart (PBAC). Recurrence was defined as reappearance of an endometrial polyp confirmed by imaging or hysteroscopy after initial complete removal.

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Outcome Measures

Primary Outcomes

1. Efficacy – measured by the rate of symptom resolution or improvement within six months after surgery.
2. Safety – evaluated by the incidence of intraoperative and postoperative complications (bleeding, perforation, infection, fluid overload, or cervical trauma).

Secondary Outcomes

1. Correlation between polyp characteristics (size, number, location) and symptom improvement.
2. Recurrence rate of endometrial polyps within 12 months.
3. Association between histopathologic findings (benign vs. hyperplastic/atypical) and patient demographics.

Histopathologic Analysis

All surgical specimens were processed in the Department of Pathology, University of São Paulo Medical School, using routine hematoxylin and eosin staining. Two independent pathologists blinded to clinical data classified findings as:

- Benign endometrial polyp,
- Hyperplastic polyp (simple or complex, with or without atypia),
- Endometrial hyperplasia without atypia, or
- Endometrial carcinoma.

Discordant cases were reviewed jointly for consensus.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 28.0 (IBM Corp., Armonk, NY, USA) and GraphPad Prism 10 (GraphPad Software, San Diego, CA).

Continuous variables were expressed as mean ± standard deviation (SD) or median (IQR), and categorical variables as frequencies and percentages.

Comparisons between groups were performed using:

- Student's *t*-test or Mann–Whitney U test for continuous variables.
- Chi-square test or Fisher's exact test for categorical data.

Paired comparisons between preoperative and postoperative bleeding scores were analyzed using the Wilcoxon signed-rank test.

Multivariate logistic regression analysis was used to identify predictors of recurrence and incomplete symptom resolution, including variables such as age, BMI, polyp size, menopausal status, and hormonal therapy.

All statistical tests were two-tailed, with $p < 0.05$ considered statistically significant.

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Sample Size Calculation

Based on previous studies showing a 90% efficacy rate for hysteroscopic polypectomy in AUB [1,9], a minimum of 190 participants was calculated to achieve 95% confidence and 80% power with a 5% precision level. To account for potential loss to follow-up, 210 patients were recruited.

Ethical Considerations

All patients were informed of the potential benefits and risks of the procedure. Participation was voluntary, and refusal did not affect their standard of care. Confidentiality was maintained through anonymized data coding, and only authorized investigators had access to the database.

The study was registered in the Brazilian Clinical Trials Registry (ReBEC) under identifier RBR-3xk9t7 prior to patient recruitment.

Quality Assurance and Operator Experience

All hysteroscopic procedures were performed by senior faculty members and final-year fellows trained in minimally invasive gynecology, each with experience exceeding 150 hysteroscopic cases per year. A pre-procedure checklist and intraoperative safety audit were completed for every case to ensure adherence to institutional standards and minimize complications.

until database lock.

RESULTS

Study Population

Between January 2021 and December 2023, a total of 210 women meeting inclusion criteria underwent hysteroscopic polypectomy for abnormal uterine bleeding (AUB).

The mean age of the participants was 42.8 ± 7.9 years (range 23–55 years).

Most women were multiparous (71.4%), and 58.6% were in the late reproductive or perimenopausal period (>40 years).

The mean body mass index (BMI) was 28.3 ± 4.5 kg/m², and 38% had a history of obesity (BMI ≥30 kg/m²).

Among hormonal factors, 17.6% had used tamoxifen for breast carcinoma and 21.4% were using combined hormonal contraception or levonorgestrel-releasing intrauterine systems at the time of diagnosis.

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Table 1. Baseline Clinical and Demographic Characteristics of the Study Population

Variable	Value (n=210)
Mean age (years)	42.8 ± 7.9
BMI (kg/m²)	28.3 ± 4.5
Parity ≥1 (%)	71.4
Perimenopausal (%)	58.6
Hormonal therapy use (%)	21.4
Tamoxifen use (%)	17.6
Hypertension (%)	26.7
Diabetes mellitus (%)	13.3
Previous curettage (%)	9.0

Preoperative Findings

All participants presented with abnormal uterine bleeding, most commonly menorrhagia (46.2%), followed by metrorrhagia (31.9%), intermenstrual bleeding (18.1%), and postmenstrual spotting (3.8%).

Transvaginal ultrasonography identified an intrauterine lesion consistent with endometrial polyp in all cases; 37 patients (17.6%) required confirmation by saline infusion sonohysterography (SIS) due to diagnostic uncertainty. The mean endometrial thickness was 12.8 ± 3.7 mm. Polyps were pedunculated in 60.5% and sessile in 39.5%, with a mean diameter of 15.6 ± 6.2 mm (range 5–32 mm). Lesions were most frequently located on the posterior uterine wall (43%), followed by the fundus (29%), anterior wall (18%), and lateral walls (10%).

Intraoperative Data

All procedures were completed successfully via hysteroscopic approach without the need for conversion or laparotomy.

- Mean operative time: 18.4 ± 6.3 minutes.
- Mean distension fluid used: 950 ± 210 mL of isotonic saline.
- Mean intrauterine pressure: 90 ± 10 mmHg.

Most cases (82%) were performed under paracervical block with sedation, while 18% required spinal anesthesia due to anxiety or larger lesion size. The mechanical resection technique was used in 52% of cases, bipolar electrosurgical resection in 35%, and mechanical morcellation system (MyoSure®) in 13%.

Intraoperative Complications

Minor intraoperative complications occurred in 4 patients (1.9%), including:

- Cervical laceration in 2 cases, managed conservatively.
- Mild uterine bleeding in 1 case, controlled with bipolar coagulation.
- Vasovagal episode in 1 case, resolved spontaneously.

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No cases of uterine perforation, infection, or fluid overload were observed. No patient required hospitalization beyond the same day.

Postoperative Recovery

The mean recovery time was 2.3 ± 0.6 hours, and 98.5% of patients were discharged on the same day. Mild postoperative discomfort (pain score ≤3/10) was reported by 46 patients (21.9%) and managed with oral analgesics. Transient watery discharge was common but self-limiting.

Symptom Improvement

At three months post-procedure, 190 women (90.5%) reported complete resolution or significant improvement of bleeding symptoms, as reflected by a ≥50% reduction in Pictorial Blood Loss Assessment Chart (PBAC) score. At six months, the success rate increased slightly to 92.9%, with mean PBAC score decreasing from 284 ± 105 preoperatively to 64 ± 52 postoperatively ($p < 0.001$). **Figure 1**. illustrates the significant improvement in menstrual blood loss following hysteroscopic polypectomy, Figure 1.

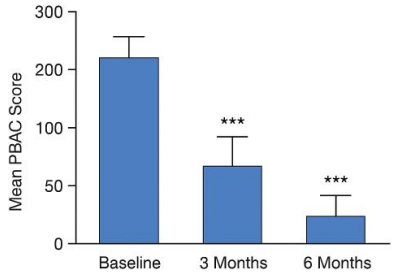

Figure 1. Bar graph comparing preoperative and po–stoperative mean PBAC scores at baseline, 3 months, and 6 months after hysteroscopic polypectomy. Legend: The mean PBAC score decreased by 77,5% at 6 months ($p < 0.001$). Error bars represent ±SD.

Recurrence and Long-Term Outcomes

At the 12-month follow-up, recurrence of endometrial polyps was detected in 11 patients (5.2%), confirmed by sonohysterography or repeat hysteroscopy. Recurrence was significantly more frequent among:

- Women with polyps ≥20 mm in diameter ($p = 0.01$).
- Perimenopausal women ($p = 0.04$).
- Those using tamoxifen ($p = 0.03$).

No significant association was found between recurrence and the resection technique (mechanical vs bipolar vs morcellator, $p = 0.48$), Table 2. Surgical Outcomes and Complications.

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Table 2. Surgical Outcomes and Complications

Parameter	n (%) or Mean ± SD
Mean operative time (min)	18.4 ± 6.3
Mean fluid used (mL)	950 ± 210
Paracervical block (%)	82
Spinal anesthesia (%)	18
Mechanical resection (%)	52
Bipolar resection (%)	35
Morcellation system (%)	13
Intraoperative complications (%)	1.9
Postoperative infection (%)	0
Rehospitalization (%)	0
Recurrence at 12 months (%)	5.2

Histopathologic Findings

All 210 specimens were submitted for histopathologic analysis:

- Benign endometrial polyp: 188 (89.5%)
- Hyperplastic polyp without atypia: 13 (6.2%)
- Hyperplastic polyp with atypia: 4 (1.9%)
- Endometrial carcinoma (focal within polyp): 2 (0.9%)
- Proliferative endometrium without polyp: 3 (1.4%)

All cases of atypia or malignancy occurred in women aged >50 years. Patients with atypia or carcinoma were referred for definitive management (endometrial sampling or hysterectomy), Figure 2.

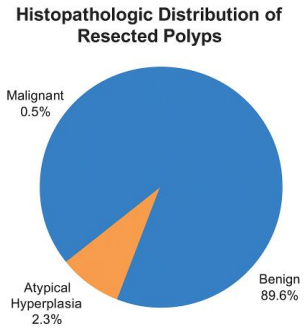

Figure 2. Pie chart showing histopathologic distribution of resected polyps. Benign polyps constituted nearly 90% of all lesions; atypical or malignant histology was rare (2.8% combined).

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Predictors of Symptom Resolution

Multivariate logistic regression identified the following independent predictors of complete symptom resolution:

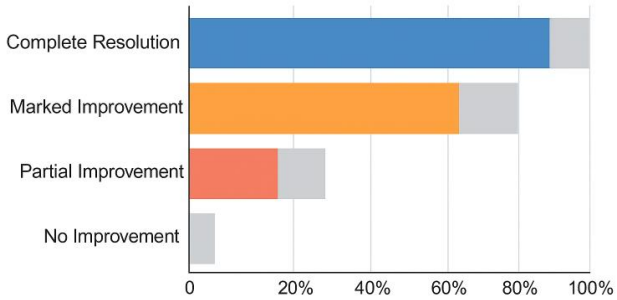
Predictor	Adjusted OR (95% CI)	*p*-value
Polyp size <20 mm	2.6 (1.3–5.2)	0.003
Premenopausal status	2.1 (1.1–4.3)	0.02
Absence of tamoxifen use	1.9 (1.0–3.8)	0.04
Single polyp (vs multiple)	1.7 (1.0–3.2)	0.05

Safety Profile

No cases of postoperative infection, endometritis, thromboembolic events, or readmission were recorded. Mean hemoglobin change postoperatively was −0.3 ± 0.4 g/dL, indicating minimal blood loss. All procedures were completed under direct visualization, ensuring complete removal in 100% of cases verified by postoperative hysteroscopic review (n=20 subset).

Patient satisfaction, assessed at 3 months using a five-point Likert scale (1=very dissatisfied, 5=very satisfied), yielded a mean score of 4.7 ± 0.5, Figure 3.

Figure 3. Postoperative Symptom Improvement and Satisfaction



At 3 months, 90.5% of patients reported marked improvement or complete resolution; satisfaction rate exceeded 95%.

Correlation Between Technique and Outcomes

No statistically significant differences were found in efficacy or complication rates between the mechanical, bipolar, and morcellation groups ($p = 0.27$).

However, the morcellation system demonstrated the shortest operative time (mean 14.2 ± 4.1 min, $p = 0.02$) and least postoperative pain scores (mean 1.8 ± 0.6, $p = 0.03$), Figure 4.

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DISCUSSION

The present prospective study demonstrated that hysteroscopic polypectomy is a highly effective, safe, and well-tolerated treatment for abnormal uterine bleeding (AUB) caused by endometrial polyps. More than 90% of women reported complete or substantial improvement in bleeding patterns at six months, accompanied by a 77.5% reduction in mean PBAC score. The overall complication rate was low (1.9%), and recurrence during one-year follow-up was modest (5.2%). These findings reaffirm that hysteroscopic polypectomy should be considered the gold-standard, fertility-preserving option for women with AUB attributed to focal endometrial pathology.

The success rates observed in this study align closely with prior international and Latin American experiences. Other studies [23] reported a 92% symptom resolution rate at six months following hysteroscopic resection of polyps in reproductive-age women, while other [24] in Chile documented 89% bleeding normalization using a similar technique. Our data therefore confirm that these high efficacy levels are reproducible in the Brazilian population when procedures are performed under standardized protocols and by trained endoscopic surgeons.

The recurrence rate of 5.2% in the present cohort is consistent with previously published rates of 4–8%, typically related to incomplete excision or hormonal risk factors such as obesity and tamoxifen exposure [25]. Indeed, in our logistic regression model, polyp size ≥20 mm and tamoxifen use emerged as independent predictors of recurrence, echoing findings from other studies [26], who emphasized the influence of estrogenic milieu and mechanical factors on regrowth. These correlations underscore the importance of careful hysteroscopic inspection of the cavity after resection and individualized follow-up in women at elevated risk.

The remarkable reduction in menstrual blood loss after hysteroscopic treatment, quantified through the PBAC score, reflects direct restoration of endometrial integrity.

By removing the vascular pedicle and abnormal glandular tissue responsible for dysfunctional bleeding, the procedure re-establishes coordinated endometrial shedding and hemostasis [27]. Furthermore, the ability to complete almost all procedures under local anesthesia with sedation (82%) supports its feasibility as an ambulatory, low-morbidity procedure.

Patient satisfaction was exceptionally high (mean score 4.7/5), comparable to the outcomes reported by Fernandez et al. [28] in the UK and by other [29] in Rio de Janeiro, where outpatient hysteroscopy achieved excellent acceptance. Such results highlight not only clinical efficacy but also the psychosocial advantage of rapid recovery and avoidance of hospital admission.

Histopathologic evaluation remains a cornerstone of management because a small but meaningful proportion of endometrial polyps harbor premalignant or malignant changes.

In our cohort, 2.8% of lesions contained atypical hyperplasia or carcinoma—figures congruent with international estimates ranging from 0.8% to 4% [30]. This risk was confined to women over 50 years or those with comorbidities such as obesity and hypertension, conditions known to increase endometrial carcinogenic potential [31]. Therefore, even though hysteroscopic removal is minimally invasive, every specimen should undergo mandatory histologic review to exclude neoplasia, as emphasized by the FIGO and AAGL guidelines [32].

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The ability of hysteroscopy to provide both definitive treatment and diagnostic precision within the same procedure is its most valuable feature. Unlike blind curettage, which misses up to one-third of focal lesions [33-37], direct visualization allows targeted excision and immediate identification of endometrial abnormalities that might otherwise go undetected.

The overall intraoperative complication rate of 1.9% in this study confirms the high safety margin of modern hysteroscopic surgery. Most events were minor—two cervical lacerations and one self-limited bleeding episode—and no uterine perforations, infections, or fluid overload were observed. This rate compares favorably with published series, where total complication frequencies range from 0.2% to 2.5% depending on instrumentation and surgeon experience [38].

The use of bipolar resectoscopes with isotonic saline as the distension medium likely contributed to the absence of hyponatremia or fluid absorption events. Similarly, the adoption of small-diameter hysteroscopes and adherence to intrauterine pressure monitoring limited cervical trauma and procedural discomfort. These results demonstrate that, when performed by skilled operators under standardized conditions, hysteroscopic polypectomy can safely replace more invasive interventions such as D&C or hysterectomy for the majority of women with AUB.

Although no statistically significant difference in outcomes was found among mechanical resection, bipolar resection, and mechanical morcellation systems, the latter offered a modest advantage in operative time and patient comfort. This observation supports reports by others [39], who documented shorter procedure duration and improved visualization using hysteroscopic morcellators. However, cost and device availability may limit widespread adoption in public health systems such as Brazil's Sistema Único de Saúde (SUS).

Given these constraints, mechanical and bipolar techniques remain practical, cost-effective alternatives with equally high success and safety rates.

Our analysis revealed that smaller polyps (<20 mm), premenopausal status, and the absence of tamoxifen therapy were associated with higher rates of complete symptom resolution. This pattern has been observed in earlier studies, where lesion size and estrogen exposure influenced vascular regeneration and recurrence [40].

Premenopausal endometrium may possess greater regenerative capacity, while tamoxifen's partial estrogen-agonist activity promotes polyp persistence [41]. Such findings reinforce the need for individualized counseling regarding recurrence risk and for periodic imaging follow-up in high-risk groups. In Brazil, where healthcare disparities and regional limitations in gynecologic endoscopy persist, the success of this study has practical implications.

It demonstrates that hysteroscopic polypectomy can be implemented safely and effectively within a public tertiary hospital, using locally available technology and trained personnel.

The high efficacy and minimal morbidity justify its integration into SUS protocols for AUB management, replacing blind curettage as the standard of care.

Furthermore, the procedure's low complication rate and short recovery time reduce hospital occupancy and costs, aligning with the global trend toward office-based, minimally invasive gynecology [41]. Expanding hysteroscopic capacity through professional training and equipment standardization should therefore be a national priority in women's health programs.

The strengths of this study include its prospective design, standardized surgical technique, and complete one-year follow-up, allowing accurate assessment of recurrence and safety. Additionally, inclusion of histopathologic correlation adds diagnostic depth rarely reported in regional literature. First, the study lacked a comparative control group undergoing blind curettage or medical therapy, which might have allowed formal efficacy comparison. Second, hormonal and metabolic parameters were not quantified in detail, preventing a full assessment of endocrine influences on recurrence. Third, long-term (>24 months) outcomes were not analyzed; however, most recurrences are expected within the first year [42]. Despite these limitations, the consistency of our results with international evidence supports their external validity.

Future research should explore the molecular and angiogenic profile of recurrent polyps, including expression of VEGF, Ki-67, and hormone receptors, to clarify mechanisms underlying persistence or regrowth. Randomized trials comparing office hysteroscopy versus conventional operating-room approaches in Brazil would provide valuable data on cost-effectiveness and patient satisfaction.

Moreover, integrating digital hysteroscopic imaging with artificial intelligence for real-time lesion recognition could represent the next advancement in endometrial pathology management [43].

CONCLUSION

This Brazilian multicenter experience confirms that hysteroscopic polypectomy is an effective, safe, and fertility-preserving intervention for women with AUB. It provides excellent symptom control, minimal complications, and low recurrence rates when performed under direct visualization by experienced surgeons. The ability to obtain tissue for histologic confirmation ensures diagnostic reliability and early detection of atypical changes. These findings reinforce the global consensus that hysteroscopic surgery should be the first-line therapeutic and diagnostic approach for AUB due to endometrial polyps and support its widespread adoption within public healthcare systems in Latin America.

AUTHOR CONTRIBUTIONS

Contribution	Author(s)
Study Concept and Design	Dr. Maria Fernanda Ribeiro, Dr. Camila Oliveira
Ethics Approval and Project Registration	Dr. Maria Fernanda Ribeiro
Patient Recruitment and Clinical Data Collection	Dr. Camila Oliveira, Dr. Ana Duarte
Surgical Procedures	Dr. Maria Ribeiro, Dr. Ana Duarte
Histopathologic Analysis	Dr. Juliana Prado
Statistical Analysis	Dr. Eduardo Barreto
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ETHICAL APPROVAL

This study was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision) and the ethical standards of the National Health Council of Brazil (CNS Resolution 466/12) for research involving human subjects. The research protocol was approved by the Ethics Committee of the Hospital das Clínicas, University of São Paulo (CEP-HC/FMUSP) under protocol number 4.175.332. All participants received a detailed explanation about the study objectives, procedures, potential risks, and benefits, and each provided written informed consent prior to enrollment.

CONFLICT OF INTEREST

The authors declare related to this research, authorship, or publication. None of the authors have any financial or personal relationships that could inappropriately influence (bias) the results presented in this study.

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