Received: 1 May 2024 | Revised: 20 March 2025 | Accepted: 12 June 2025

DOI: 10.1002/ijgo.70347

REVIEW ARTICLE

Gynecology

Efficacy, safety, and feasibility of the treatment of intrauterine pathologies with the hysteroscopic morcellator: A systematic review

Andrea Etrusco[1,2] | Vittorio Agrifoglio[1,2] | Vito Chiantera[2,3] | Antonio Simone Laganà[1,2] | Stefano Bettocchi[4] | Clementina Cantatore[5] | Ettore Cicinelli[6] | Amerigo Vitagliano[6] | Gaetano Riemma[7] | Luigi Nappi[8] | Felice Sorrentino[8] | Alessandro Favilli[9] | Andrea Giannini[10] | Antonio D'Amato[6]

[1]Unit of Obstetrics and Gynecology, "Paolo Giaccone" Hospital, Palermo, Italy

[2]Department of Health Promotion, Mother and Child Care, Internal Medicine and Medical Specialties (PROMISE), University of Palermo, Palermo, Italy

[3]Unit of Gynecologic Oncology, National Cancer Institute—IRCCS—Fondazione "G. Pascale", Naples, Italy

[4]Department of Medical and Surgical Sciences, Unit of Gynecology and Obstetrics, University of Foggia, Foggia, Italy

[5]Department of Advanced Reproductive Risk Management and High-Risk Pregnancies, ASL Bari, Reproductive and IVF Unit, PTA Conversano, Conversano, Italy

[6]Unit of Obstetrics and Gynecology, Department of Interdisciplinary Medicine (DIM), University of Bari "Aldo Moro", Policlinico of Bari, Bari, Italy

[7]Department of Woman, Child and General and Specialized Surgery, University of Campania "Luigi van-Vitelli", Naples, Italy

[8]Department of Medical and Surgical Sciences, Institute of Obstetrics and Gynecology, University of Foggia, Foggia, Italy

[9]Section of Obstetrics and Gynecology, Department of Medicine and Surgery, University of Perugia, Perugia, Italy

[10]Unit of Gynecology, "Sant'Andrea" Hospital, Department of Surgical and Medical Sciences and Translational Medicine, Sapienza University of Rome, Rome, Italy

Abstract

Background: Hysteroscopy has evolved from a diagnostic to a diagnostic and operative tool, and currently represents the reference standard for both the diagnosis and treatment of intrauterine diseases. In this context, the hysteroscopic morcellator is increasingly gaining popularity because of its simplified approach.

Objectives: To evaluate the efficacy, safety, and feasibility of the hysteroscopic morcellator for the treatment of intrauterine pathologies.

Search Strategy: Electronic databases were searched for English-language trials describing surgical procedures for uterine pathologies performed with the hysteroscopic morcellator until February 1, 2024.

Selection Criteria: Retrospective or prospective original studies reporting the treatment of uterine pathologies with the hysteroscopic morcellator were included.

Data Collection and Analysis: Data were collected on study features, characteristics of included populations, surgical procedures, complications, and results/outcomes.

Main Results: Thirty-nine papers that met the inclusion criteria were included in this systematic review. A descriptive synthesis of the results was provided according to the pathology that was hysteroscopically removed/corrected: endometrial polyps, uterine leiomyomas, and retained products of conception.

Conclusions: The hysteroscopic morcellator offers effective and efficient removal of intrauterine lesions, with minimal risk of complications. Despite some limitations identified, such as potential bleeding and the need for additional surgical steps in certain cases, the overall findings support the utility of this technique in clinical practice.

KEYWORDS

endometrial polyps, fibroids, hysteroscopic surgery, hysteroscopy

Correspondence
Antonio D'Amato, Unit of Obstetrics and Gynecology, Department of Interdisciplinary Medicine (DIM), University of Bari "Aldo Moro", Policlinico of Bari, Piazza Giulio Cesare 11, 70124 Bari, Italy.
Email: antoniodamato19@libero.it

1 | INTRODUCTION

In the past, hysteroscopy was considered primarily a diagnostic tool aimed at direct examination of the uterine cavity. Over time, it has evolved into the preferred method for both diagnosis and treatment of various intrauterine pathologies, including polyps, myomas, abnormalities, and post-surgical complications.[1–5] In addition, hysteroscopy has become a commonly used method in preliminary or second-level investigations of infertile patients.[6,7] Advances in hysteroscope design, specifically tailored to the cervical canal, have eased the transition of procedures from the operating room to outpatient settings. This has not only minimized patient discomfort but also enhanced global adoption of the technique. The integration of diagnostic and operative phases has led to the modern "see-and-treat" approach, reducing the need for multiple procedures and enhancing overall patient satisfaction.[8–10]

Currently, within the context of gynecologic endoscopic surgery, there is a wide range of instruments capable of safely, effectively, and swiftly treating nearly all intrauterine pathologies.[11,12] Among these, the hysteroscopic morcellator is increasingly gaining popularity because of its simplified approach, demonstrated by a rapid learning curve, and further reduction in patient discomfort.[13] Furthermore, significant technologic advancements have allowed for a progressive reduction in the outer diameter of the morcellator, coupled with an increase in the instrument's effectiveness, taking the technique to an even higher level. All of these enhancements now enable the extraction of intracavitary pathology in a manner that is increasingly painless, fast, and safe, ideally suited for outpatient procedures.

The aim of this systematic review was to evaluate the efficacy, safety, and feasibility of the hysteroscopic morcellator for the treatment of intrauterine pathologies.

2 | MATERIALS AND METHODS

2.1 | Eligibility criteria

Only original studies (retrospective or prospective) reporting the treatment of uterine and endometrial pathologies using the hysteroscopic morcellator were deemed eligible for inclusion in this systematic review. Studies involving different types of operative hysteroscopy, studies describing only the procedure technique ("step-by-step" procedure description), case report, or case series with fewer than 10 enrolled patients were excluded.

2.2 | Information sources

The present study was carried out according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines,[14] available through the Enhancing the Quality and Transparency of Health Research (EQUATOR) network, and the Cochrane Handbook for Systematic Reviews.[15] It was registered with the international prospective register of systematic reviews (PROSPERO) under the registration number CRD42024509353.

MEDLINE, EMBASE, Global Health, The Cochrane Library (Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register), Health Technology Assessment Database, Web of Science, and research register (ClinicalTrial.gov) were searched for studies describing surgical procedures for uterine and endometrial pathologies using the hysteroscopic morcellator.

2.3 | Search strategy

The following medical subject heading (MeSH) and key search terms were used: "Hysteroscopy" (MeSH Unique ID: D015907) OR "Hysteroscopic surgery" (MeSH Unique ID: D015907) OR "Morcellation" (MeSH Unique ID: D000069577) AND "Leiomyoma" (MeSH Unique ID: D007889) OR "Endometrial polyps" (MeSH Unique ID: D011127) OR "Incomplete abortion" (MeSH Unique ID: D000027) OR "Retained placenta" (MeSH Unique ID: D018457) OR "Uterine Synechiae" (MeSH Unique ID: D006175), OR "Isthmocele". We selected papers written in English, from the inception of each database until February 1, 2024.

2.4 | Study selection

Titles and/or abstracts of studies retrieved using the search strategy were screened independently by two authors (AE and AD) to identify studies that met the inclusion criteria. The full texts of these potentially eligible articles were retrieved and independently assessed for eligibility by two other review team members (ASL and

VA). A manual search of the references of the included studies was conducted to prevent the omission of pertinent research. Any disagreement between them over the eligibility of articles was resolved through discussion with two other authors (FS and AF). All authors approved the final selection.

2.5 | Data extraction

Two authors (VC and SB) independently extracted data from articles about study features, characteristics of included populations, surgical procedures, complications, and results/outcomes using a pre-piloted standard form to ensure consistency. Two authors (CC and LN) reviewed the entire data extraction process.

2.6 | Assessment of risk of bias

Two reviewers (EC and AV) assessed independently the risk of bias of studies included in this systematic review using a modified version of the Newcastle-Ottawa Scale.[16] Quality of studies was evaluated in the following five different domains: "study design and sample representativeness", "sampling technique", "description of the hysteroscopic technique", "quality of the population description", and "incomplete outcome data" (Table S1). Any disagreements between the reviewers were resolved by two other authors (GR and AG).

2.7 | Outcomes measures and data synthesis

The primary outcome of this study was to evaluate the efficacy, safety, and feasibility of the hysteroscopic morcellator for the treatment of intrauterine pathologies.

- Effectiveness was measured through the rate of successful procedures, as determined by the lack of residual lesion at the end of the procedure and/or at follow-up visit.
- Feasibility was evaluated as the rate of completed procedures in a single surgical step, without any interruptions due to surgical issues or patient's complaint.
- Safety was determined by the rate of intraoperative and postoperative complications.

Quantitative analysis was not possible because of data heterogeneity (including different settings and surgical procedures). We provided a descriptive synthesis of the results in separate sections based on the type of pathology that was removed or corrected: polyps, leiomyomas, and retained products of conception (RPOC).

The body of evidence on the usefulness of the hysteroscopic morcellator for each pathology was assessed by two authors (AD and AE) using Oxford Centre for Evidence-Based Medicine (OCEBM) 2011 Levels of Evidence.[17]

3 | RESULTS

3.1 | Study selection

Study selection is displayed in Figure 1. After the evaluation of full texts, a total of 39 papers,[18–56] which met the above-mentioned inclusion criteria, were included in the present systematic review.

3.2 | Study characteristics

The main characteristics of the included studies are summarized in Table 1. Fifteen studies were retrospective.[18,20–24,32,34–36,40,43,46,54,55] The other 25 included studies were prospective, including 15 randomized controlled trials (RCTs)[19,25–30,38,39,41,42,47,48,50,52] and nine prospective cohort studies.[31,33,37,44,45,49,51,53,56] Of these, eight studies are from Belgium,[20,23,27,28,39,42,48,51] five from the Netherlands,[18,19,47,52,53] five from the USA,[22,30,33,43,50] four from China,[21,34,54,55] four from Spain,[25,29,44,49] four from Italy,[24,35,40,56] three from the UK,[26,36,46] two from Australia,[31,37] one from Israel,[45] one from Hong Kong,[32] one from Japan,[38] and one from France.[41]

3.3 | Risk of bias of included studies

Among the 40 studies included in the present qualitative analysis, 36 were at low risk of bias in three or more domains[18–33,35–45,47,51–55] and three were judged at high risk of bias.[34,46,56] A detailed description of the risk of bias in each domain among studies is reported in Table S2.

3.4 | Synthesis of the results

Among the included studies, nine evaluated the use of the hysteroscopic morcellator for the treatment of uterine leiomyomas,[24,32,34,37,42,44,50,55] 14 for the treatment of endometrial polyps,[21,22,25–27,29,35,38,40,41,43,47,48,51] seven for both pathologies[18–20,30,31,33,46]; and eight studies assessed the safety of using the morcellator for treating RPOC.[23,28,39,45,49,52,53,56] Finally, two studies evaluated the use of a hysteroscopic morcellator for the treatment of polyps, leiomyomas, and RPOC together.[36,54] As previously mentioned, we discussed the results separately based on the type of uterine pathology treated in the various included studies. Eight different types of morcellator were used through the included studies, as detailed in Table 2. The level of evidence on the use of hysteroscopic morcellator for each operative procedure is summarized in Table 3.

3.5 | Uterine leiomyomas

Nine studies have examined the utility of the hysteroscopic morcellator in the treatment exclusively of uterine leiomyomas.[24,32,34,37,42,44,50,55,57]

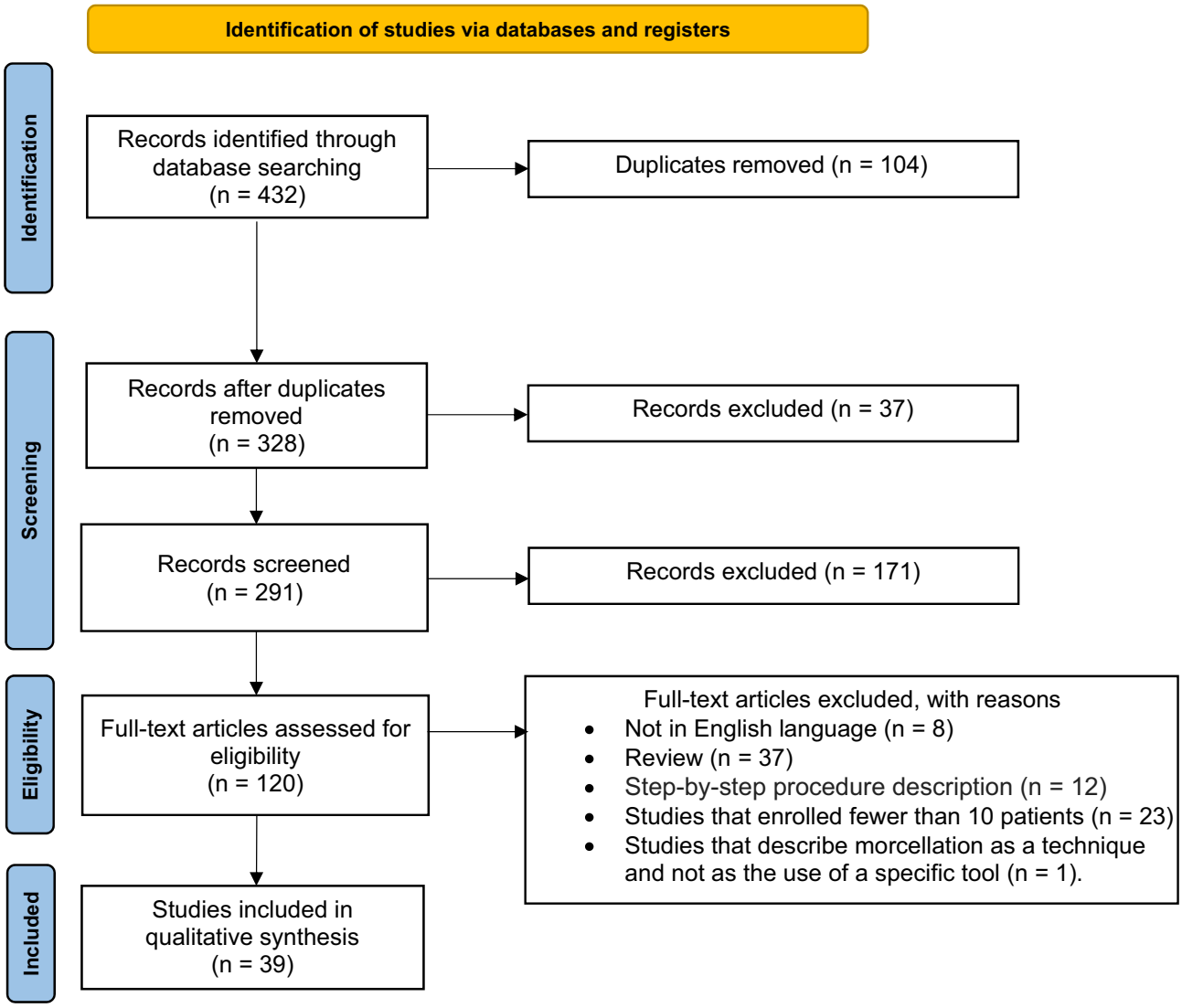

FIGURE 1 PRISMA 2020 Flow diagram of the study. From: Page et al.[14] For more information, visit: http://www.prisma-statement.org/.

Bigatti et al.[24] compared retrospectively 76 hysteroscopic myomectomies performed with the Integrated Bigatti Shaver® (IBS®, Karl Storz GmbH, Tuttlingen, Germany) with 51 performed using the Versapoint® (currently produced by Olympus, Tokyo, Japan). Patients were divided into groups not only on the basis of the device used (hysteroscopic morcellator and Versapoint®), but also on the basis of the myomas removed (<30 mm and >30 mm). No difference was found between the two methodologies in terms of cervical dilatation, resection time, and fluid deficit, but, for myomas smaller than 30 mm and G2 myomas, the IBS® was able to treat 93.5% ($P=0.3753$) and 62.5% ($P=0.5491$) of cases, respectively, through a single-step procedure, with an overall lower number of second-step surgeries required in the IBS® group than in the Versapoint® group ($P=0.0067$).

Zhang et al.[55] compared the outcomes after hysteroscopic myomectomy with the IBS® using different rotation speeds and aspiration flow rates, finding a recommended rotational speed of 1500 rotations per minute (rpm) and aspiration flow rate of 500 mL/min as the most effective for achieving a complete one-step resection of the myoma. In this study the average size of myomas was 22.69 ± 10.995 mm for group A (rotational speed 2500 rpm and aspiration flow rate of 250 mL/min) and 23.68 ± 9.249 mm for group B (rotational speed 1500 rpm and aspiration flow rate of 500 mL/min).

Lee and Matsuzono[32] compared hysteroscopic morcellation (HM) using the MyoSure® (Hologic, Bedford, MA, USA) with conventional monopolar resectoscopic surgery for hysteroscopic myomectomy. The operating time was significantly reduced for HM versus conventional monopolar loop resection (mean 36.6 mins vs. 53.6 mins; $P=0.005$), with myomas of 3.0 cm or less (mean 27.6 mins vs. 53.4 mins; $P=0.019$). Comparable outcomes were achieved through an RCT by Van Wessel et al.[42] using the TruClear™ 8.0 system (previously: Smith & Nephew, Andover, MA, USA; currently: Medtronic, Minneapolis, MN, USA).

Valero et al.[44] compared HM with another minimally invasive approach for the treatment of myomas, using the

TABLE 1 Characteristics of the included studies.[a]

Author	Year	Type	Main outcome	Country	Patients	Age, years	Control group
Emanuel et al.[18]	2005	Retrospective comparative	To compare a new hysteroscopic operating technique with conventional resectoscopy	Netherlands	55	Polyp resection: 51.6 ± 11.7 Polyps morcellation: 48.9 ± 11.3 Myoma resection: 37.9 ± 6.6 Myoma morcellation: 44.6 ± 9.4	216 controls treated with conventional transcervical resection
Van Dongen et al.[19]	2008	Randomized Controlled pilot study	To compare conventional resectoscopy and hysteroscopic morcellation among residents in training	Netherlands	59	Morcellator: 49.0 ± 10.9 Resectoscopy: 48.2 ± 12.4	30 controls treated with conventional resectoscopy
Hamerlynck et al.[20]	2011	Retrospective comparative	To report the authors' experience with the hysteroscopic morcellator for removal of intrauterine myomas and polyps	Belgium	315	Myoma: 45 (26–49) Polyp: 47 (23–81)	None
Yong et al.[21]	2021	Retrospective observational	To investigate the clinical efficacy of the MyoSure hysteroscopic tissue removal system in the treatment of endometrial and cervical polyps in women with an intact hymen	China	32	24.88 ± 6.61	None
AlHilli et al.[22]	2012	Retrospective comparative	To compare the long-term outcomes of intrauterine morcellation of endometrial polyps versus a traditional operative polypectomy technique, hysteroscopic resection, and to identify factors predictive of recurrent abnormal uterine bleeding after operative polypectomy	USA	311	Hysteroscopic resection: 53.9 ± 12.3 Hysteroscopic morcellation: 55.4 ± 11.4	172 controls treated with hysteroscopic resection
Hamerlynck et al.[23]	2013	Retrospective observational	To evaluate the authors' initial experience with hysteroscopic morcellation for removal of placental remnants	Belgium	105	33.5 ± 4.2	None
Bigatti et al.[24]	2014	Retrospective comparative	To compare 76 myomectomies performed with the IBS® with 51 with the Versapoint® to evaluate whether this new technique offers real advantages	Italy	127	IBS group: 47.3 ± 10.1 Versapoint group: 48.04 ± 11.4	51 patients treated with bipolar hysteroscopic myomectomy
Rovira Pampalona et al.[25]	2014	Randomized controlled trial	To assess and compare efficacy, pain, and the learning curve associated with diagnostic therapeutic hysteroscopy using mechanical tissue removal versus bipolar electrical resection in the management of endometrial polyps in an ambulatory care setting	Spain	133	Truclear: 55 (SD n.a.) Versapoint: 52 (SD n.a.)	133 patients diagnosed with endometrial polyp(s) randomly assigned to 1 of the 2 hysteroscopic methods
Smith et al.[26]	2014	Randomized controlled trial	To evaluate whether hysteroscopic morcellation or bipolar electrosurgical resection is more favorable for removing endometrial polyps in an office setting	UK	121	Hysteroscopic morcellation: 54.3 ± 12.7 Electrical resection: 54.9 ± 14.2	121 women randomly allocated to polyp removal by one of the two methods in an office setting

(Continues)

TABLE 1 (Continued)

Author	Year	Type	Main outcome	Country	Patients	Age, years	Control group
Hamerlynck et al.[27]	2015	Randomized controlled trial	To compare hysteroscopic morcellation with bipolar resectoscopy for removal of endometrial polyps, in terms of procedure time, peri- and postoperative adverse events, tissue availability, and short-term effectiveness	Belgium	84	Hysteroscopic morcellation: 50 ± 10 Resectoscopy: 51 ± 12	84 women randomized in the hysteroscopic morcellation and resectoscopy group
Hamerlynck et al.[28]	2016	Randomized controlled trial	To compare hysteroscopic morcellation with loop resection for the removal of placental remnants in terms of procedure time, adverse events, tissue availability, histology results, short-term effectiveness, and postoperative adhesions	Belgium	86	Hysteroscopic morcellation: 32 ± 6 Resectoscopy: 31 ± 4	40 controls randomly selected undergoing conventional resectoscopic technique
Rovira Pampalona et al.[29]	2015	Randomized controlled trial	To assess the total duration of hysteroscopy and polypectomy performed in an outpatient setting comparing the new mechanical energy hysteroscopy to the bipolar energy system	Spain	90	Versapoint: 58.9 (54.11–63.82) Truclear: 49.4 (45.69–53.17)	90 patients randomly assigned to 4 groups, Truclear, Versapoint, Truclear with residents, and Versapoint with residents
Rubino et al.[30]	2014	Randomized controlled trial	To examine efficacy of hysteroscopic removal of polyps and myomas on health-related quality of life and symptom severity at 1-year postprocedure	USA	118	Office: 41.2 ± 7.0 Ambulatory surgery center: 41.7 ± 7.1	Patients randomized to undergo hysteroscopic morcellation in an office setting or in an ambulatory surgery center
Arnold et al.[31]	2016	Prospective cohort	To determine the effectiveness of the MyoSure® intrauterine mechanical morcellator device for removal of intrauterine pathology	Australia	255	44 (22–82)	None
Lee et al.[32]	2016	Retrospective observational	To determine the safety, satisfaction, and efficiency of hysteroscopic intrauterine morcellation of submucosal fibroids, and to compare this technique with conventional hysteroscopic monopolar loop resection	Hong Kong	29	n.d.	None
Scheiber et al.[33]	2016	Prospective observational	To explore the feasibility of hysteroscopic morcellation across a diverse set of facilities, including both surgical and office-based settings	USA	278	43.9 ± 9.0	None
Liang et al.[34]	2017	Retrospective observational	To determine whether clinical evaluation of improved MyoSure hysteroscopic tissue removal system can remove type II submucosal myomas with safety and high success rate of the first operation	China	53	35.06 ± 12.72	None
Ceci et al.[35]	2018	Retrospective observational	To evaluate feasibility, effectiveness and patient acceptability of a small-diameter hysteroscopic tissue removal system in the treatment of large endometrial polyps (≥20 mm)	Italy	146	52.1 ± 12.05	None

TABLE 1 (Continued)

Author	Year	Type	Main outcome	Country	Patients	Age, years	Control group
Georgiou et al.[36]	2018	Retrospective cohort	To elucidate the hysteroscopic tissue removal system (MyoSure) efficacy and safety among uterine cavity pathologies, and to determine its feasibility in an outpatient setting	UK	124	51.16 (24–81)	None
Maheux-Lacroix et al.[37]	2017	Prospective cohort	To assess the long-term efficacy of hysteroscopic morcellation of submucosal leiomyomas in women with abnormal uterine bleeding	Australia	73	43 ± 9	None
Tsuchiya et al.[38]	2018	Randomized controlled trial	To evaluate the Truclear™ system in terms of the operating time, surgeon's convenience, and effect on patients compared with conventional electrosurgical resection	Japan	67	Morcellation: 37.5 ± 6.1 Electrosurgical resection: 39.2 ± 5.9	67 patients randomly allocated to undergo hysteroscopic morcellation or electrosurgical resection
van Wessel et al.[39]	2019	Randomized controlled trial	To evaluate the reproductive outcomes in women treated for retained products of conception by hysteroscopy (morcellation versus loop resection)	Belgium	86	Morcellation: 32 (28–38) Loop resection: 34 (27–37)	None
Ceci et al.[40]	2020	Retrospective comparative	To compare the recurrence of benign endometrial polyps after office hysteroscopic polypectomy performed with a bipolar electrode or a small-diameter hysteroscopic tissue removal system	Italy	90	Bipolar electrode: 41.4 ± 5.7 Hysteroscopic tissue removal: 40.8 ± 5.7	48 controls undergoing hysteroscopic polypectomy with bipolar electrode
Stoll et al.[41]	2020	Randomized controlled trial	To compare a reusable hysteroscopic morcellator and standard resectoscopes in the hysteroscopic management of uterine polyps	France	90	54.5 ± 11.3	90 patients were randomized, 45 in the hysteroscopic morcellation group and 45 in the standard resection group
Van Wessel et al.[42]	2021	Randomized controlled trial	To compare hysteroscopic morcellation with bipolar resection for the removal of submucous type 0 and 1 myomas	Belgium	83	Hysteroscopic morcellation: 45 ± 7 Resectoscopy: 44 ± 8	83 patients randomized to hysteroscopic morcellation with the TruClear™ or to bipolar resection
Kavoussi et al.[43]	2021	Retrospective observational	To determine if hysteroscopic morcellation of endometrial polyps affects implantation rate, clinical pregnancy rate, spontaneous abortion rate, and live birth rate in first frozen embryo transfer cycles	USA	135	Group A: 35.40 ± 3.10 Group B: 35.08 ± 4.25	Group B: no hysteroscopic polypectomy before first frozen embryo transfer ($n = 110$)
Valero et al.[44]	2021	Prospective observational	To compare the results of hysteroscopic myomectomy when using whether the mini-resectoscope or the MyoSure morcellator	Spain	80	Mini-resectoscope: 45.77 ± 6.57 Hysteroscopic morcellation: 44.47 ± 6.47	40 patients undergoing polypectomy with mini-resectoscope
Weinberg et al.[45]	2021	Prospective pilot study	To evaluate initial feasibility and experience with guided hysteroscopic morcellation for uterine evacuation of early miscarriage.	Israel	10	34.4 ± 7.2	None

(Continues)

TABLE 1 (Continued)

Author	Year	Type	Main outcome	Country	Patients	Age, years	Control group
Bhagat et al.[46]	2022	Retrospective observational	To evaluate the safety and efficacy of hysteroscopic morcellation of endometrial polyps and submucosal fibroids in an outpatient setting	UK	249	54 (31–83)	None
Van Gemert et al.[47]	2022	Randomized controlled trial	To evaluate the effectiveness of the electrosurgical polyp snare in comparison with a tissue removal device	Netherlands	66	Electrosurgical snare: 59.7 ± 10.0 Hysteroscopic morcellation: 56.2 ± 14.5	66 patients randomly allocated to treatment with electrosurgical polyp snare or hysteroscopic morcellation
Van Wessel et al.[48]	2022	Randomized controlled trial	To compare manual with electromechanical morcellation for hysteroscopic polypectomy	Belgium	140	Manual Hysteroscopic morcellation: 53.0 ± 13.0 Automatic Hysteroscopic morcellation: 51.0 ± 11.0	140 patients randomly assigned to manual or electromechanical morcellation
Bailòn Queiruga et al.[49]	2023	Prospective observational	To assess effectiveness, safety and patient satisfaction of hysteroscopic removal of retained products of conception using a tissue removal system in the outpatient setting	Spain	52	31.2 ± 7.3	None
Tam et al.[50]	2023	Randomized clinical trial	To evaluate the quality of life in patients treated for submucosal leiomyomas after hysteroscopic myomectomy compared to medical therapy	USA	69	Medical treatment: 39.9 ± 8.5 Hysteroscopy: 44.1 ± 5.7	69 patients randomized to oral contraceptive pills/progesterone-releasing intrauterine device or hysteroscopic myomectomy
Van Wessel et al.[51]	2023	Prospective cohort	A first clinical evaluation of a new hand-driven hysteroscopic tissue removal device, Resectr™ 5fr, for office polypectomy without any anesthesia	Belgium	102	51 ± 13	None
Wagenaar et al.[52]	2023	Randomized clinical trial	To study the comparison between hysteroscopic morcellation of retained products of conception with ultrasound-guided electric vacuum aspiration in terms of intrauterine adhesion formation, efficacy, and complications	Netherlands	133	n.d.	133 women randomized to receive either hysteroscopic morcellation or electric vacuum aspiration
Wagenaar et al.[53]	2023	Prospective cohort	To compare intrauterine adhesion formation after hysteroscopic morcellation of retained products of conception with intrauterine adhesion formation after ultrasound-guided electric vacuum aspiration and externally validate the outcomes of a randomized controlled trial	Netherlands	178	Hysteroscopic morcellation: 32 ± 4.0 Electric vacuum aspiration: 32 ± 3.9	28 patients treated with electric vacuum aspiration

TABLE 1 (Continued)

Author	Year	Type	Main outcome	Country	Patients	Age, years	Control group
Yong et al.[54]	2023	Retrospective comparative	To compare and analyze the clinical efficacy and reproductive outcomes of the hysteroscopic tissue removal system (MyoSure) and hysteroscopic electroresection in the treatment of benign intrauterine lesions in women of reproductive age	China	1879	Myosure group Submucous leiomyomas: 33.79 ± 5.96 Endometrial polyps: 31.53 ± 7.01 Retained products of conception: 29.63 ± 3.88 Electroresection group Submucous leiomyomas: 34.89 ± 4.20 Endometrial polyps: 33.37 ± 6.51 Retained products of conception: 29.99 ± 4.09	1133 patients who underwent hysteroscopic electroresection
Zhang et al.[55]	2023	Retrospective comparative	To evaluate whether the Intrauterine IBS® instrument settings and the myoma size and type are prognostic factors for the complete removal of submucous myomas using this technology	China	191	Group A: 48.77 ± 9.85 Group B: 45.51 ± 8.77	Patients undergoing hysteroscopic myomectomy with hysteroscopic morcellation with two different rotational speeds and aspiration flow rate
Damiani et al.[56]	2023	Prospective observational	To assess the hysteroscopic morcellation as a surgical-therapeutic approach in the treatment of retained products of conception	Italy	22	34.0 (27.0–41.0)	None

Abbreviations: n.d., not determined; SD (n.a.), standard deviation not available.

[a]Data are presented as number for Patients and as mean ± standard deviation or median (range) for Age (in years).

TABLE 2 Characteristics of hysteroscopic morcellators used in the included studies.

Size and name	Composition of the instrument	Rotation force	Rotations per minute	Company	Authors
TruClear™ 8.0	4.5-mm inner instrument introduced through the straight working channel of a continuous flow 9-mm rigid endoscope	Electromechanic	750	Medtronic, Minneapolis, MN, USA Developed by Smith & Nephew Endoscopy, Andover, MA, USA	Emanuel et al.[18] Van Dongen et al.[19] Hamerlynck et al. 2011[20] AlHilli et al.[22] Hamerlynck et al.[23] Hamerlyck et al.[27] Hamerlynck et al.[28] Tsuchiya et al.[38] Wagenaar et al.[52] Wagenaar et al.[53]
TruClear™ Elite	6.25- or 7.25-mm outer sheath, 3 mm working channel. 201.1 mm working length.	Electromechanic		Medtronic, Minneapolis, MN, USA Developed by Smith & Nephew Endoscopy, Andover, MA, USA	Weinberg et al.[45] Wagenaar et al.[52]
MyoSure™ Lite	2.5-mm inner blade, 3-mm outer tube, outer sheath 6.25-mm cutting window length of 10.2 mm and depth of 1.5 mm	Electromechanic	6000	Hologic, Marlborough, MA, USA	Yong et al.[21] Arnold et al.[31] Lee et al.[32] Scheiber et al.[33] Georgiou et al.[36] Maheux-Lacroix et al.[37] Valero et al.[44] Bhagat et al.[46] Yong et al.[54]
MyoSure™ XL	2.5-mm inner blade, 3-mm outer tube, outer sheath 7.25-mm cutting window length of 14 mm and depth of 2.4 mm	Electromechanic	8075	Hologic, Marlborough, MA, USA	Arnold et al.[31] Liang et al.[34] Georgiou et al.[36] Maheux-Lacroix et al.[37] Bhagat et al.[46]
Integrated Bigatti Shaver (IBS®)	Two hollow reusable metal tubes fitting into each other. Diameter of the outer sheath 8 mm (24 Fr)	Electromechanic	5000	Karl Storz GmbH, Tuttlingen, Germany	Bigatti et al.[24] Wagenaar et al.[53] Zhang et al.[55]
TruClear™ 5.0	5-mm hysteroscope with a 0° angle and a 5.6-mm sheath equipped with a 2.9-mm-diameter tissue removal device in the working channel	Electromechanic		Medtronic, Minneapolis, MN, USA Developed by Smith & Nephew Endoscopy, Andover, MA, USA	Rovira Pampalona et al.[25] Smith et al.[26] Rovira Pampalona et al.[29] Ceci et al.[35] Kavoussi et al.[43] Van Gemert et al.[47] Queiruga et al.[49] Tam et al.[50]
Resectr™ 9 Fr	3-mm (9-Fr) instrument diameter, cutting window 7.5 mm	Manual	Dependent on surgeon	Minerva Surgical, Inc. Santa Clara, CA, USA	Van Wessel et al.[48]
Resectr™ 5 Fr	1.66-mm (5-Fr) instrument diameter, cutting window 5 mm inserted into the operative channel of a diagnostic hysteroscope <5 mm	Manual	Dependent on surgeon	Minerva Surgical, Inc. Santa Clara, CA, USA	Van Wessel et al.[51]

TABLE 3 Levels of evidence according to Oxford Centre for Evidence-Based Medicine (OCEBM) 2011.[a]

Clinical condition	OCEBM level of evidence (2011)[17]
Uterine leiomyomas	Level 2
Endometrial polyps	Level 2
Retained products of conception (RPOC)	Level 2

[a]Level 2 evidence refers to moderate-quality evidence derived from well-designed cohort studies or diagnostic studies with consistently applied reference standards, according to the Oxford Centre for Evidence-Based Medicine – 2011 Levels of Evidence.[17]

mini-resectoscope. No statistically significant differences between groups were found except for a shorter entrance time for the mini-resectoscope.

The safety and effectiveness of the hysteroscopic morcellator for the treatment of submucous fibroids was corroborated also by Maheux-Lacroix et al.[37] and by Liang et al.[34] in two prospective observational studies, with analogous findings. The size of the treated myomas was again similar to previous studies: 33 ± 13 mm[37] and 3.88 ± 1.39 cm.[34]

Finally, Tam and Juarez[50] conducted an RCT evaluating the quality of life of 69 patients previously randomized to undergo HM or medical therapy of symptomatic fibroids. Despite no statistically significant difference in overall quality of life, significant improvements were noted in health-related quality of life scores post-surgery.

Quality of evidence

The evidence regarding the safety, effectiveness, and reliability of employing the hysteroscopic morcellator for the surgical excision of uterine leiomyomas has been classified as evidence level 2.

3.6 | Endometrial polyps

Fourteen studies examined the efficacy of the hysteroscopic morcellator in managing endometrial polyps.[21,22,25–27,29,35,38,40,41,43,47,48,51] Of these, five compared HM with traditional hysteroscopic resection technique.[22,26,27,38,41]

AlHilli et al.[22] compared the long-term outcomes of endometrial polypectomy with hysteroscopic morcellator compared with the traditional hysteroscopic resection technique, finding a lower recurrence rate after HM. Furthermore, morcellation demonstrated significantly faster procedures, less discomfort, higher acceptability among women, and greater complete removal rate of endometrial polyps when compared with electrosurgical resection in the RCT conducted by Smith et al.[26] Equal outcomes were found in three other RCTs, respectively by Hamerlynck et al.[27] Stoll et al.[41] and Tsuchiya et al.[38]

Ceci et al.[40] evaluated the 1-year follow-up outcomes in 48 women treated by bipolar electrode and 42 women undergoing HM. No difference was found in terms of complete removal and recurrence of polyps. Nevertheless, HM was associated with a lower surgical pain and time of procedure compared with bipolar electrode. Comparable findings were found by Rovira Pampalona et al.[25,29] in two distinct RCTs.

Hysteroscopic morcellation of endometrial and cervical polyps with the MyoSure® was safe and effective in women with an intact hymen, as shown by a retrospective study by Yong et al.[21] Parallel results were obtained by Ceci et al.[35] in a retrospective evaluation of large endometrial polyps (≥20 mm) treated with Truclear™ 5C.

Kavoussi et al.[43] evaluated the in vitro fertilization (IVF) outcomes after the first frozen embryo transfer following endometrial polypectomy with Truclear™ 5.0 in infertile women, showing no adverse effects on implantation rate (IR), clinical pregnancy rate (CPR), miscarriage rate, and live birth rate when compared with women who did not undergo hysteroscopic polypectomy because they had no polyps diagnosed before a first frozen embryo transfer.

Van Gemert et al.[47] compared HM with endometrial polypectomy using the electrosurgical polyp snare in an RCT including 66 women with an endometrial polyp. A higher rate of complete polyp resection, and higher overall safety and patient satisfaction were found among the HM group.

Finally, van Wessel et al.[48] demonstrated the non-inferiority of a new hand-driven hysteroscopic morcellator (Resectr™ 9Fr) compared with conventional electromechanical HM (TruClear™) for hysteroscopic polypectomy in terms of mean instrumentation set-up time and total procedure time, whereas findings regarding the duration of resection were unclear. The same group recently assessed the feasibility of HM with a further miniaturized version of the same instrument, Resectr™ 5Fr, in a first clinical evaluation of 102 women with endometrial polyps.[51]

Quality of evidence

We found adequate quality evidence (level 2) supporting the effectiveness, feasibility, and safety of using the hysteroscopic morcellator for outpatient endometrial polypectomy.

3.7 | Endometrial polyps and leiomyomas

Thirty studies evaluated the use of the hysteroscopic morcellator for the treatment of endometrial polyps and uterine leiomyomas, including 12 RCTs,[19,25–27,29,30,38,41,42,47,48,50] five prospective[31,33,37,44,51] and 12 retrospective studies.[18,20–22,24,32,34,35,40,43,46,55]

Seven studies among the above-mentioned analyzed the HM efficacy in the treatment of both endometrial polyps and uterine leiomyomas.[18–20,30,31,33,46]

A first analysis regarding the treatment of both pathologies with HM came from Emanuel and Wamsteker.[18] Fifty-five women, of whom 27 had endometrial polyps and 28 had submucous myomas, were treated with the Intra Uterine Morcellator prototype (originally developed by Smith & Nephew Endoscopy, Andover, MA, USA) and conventional

resectoscopy. The HM technique demonstrated a faster operating time in the management of both pathologies. Similar results were obtained subsequently in an RCT by van Dongen et al.[19] involving residents in training. The feasibility of HM was validated by three descriptive studies by Hamerlynck et al.[20] Arnold et al.[31] and Bhagat et al.[46] Finally, HM was associated with a higher quality of life and patient satisfaction compared with the traditional technique, as demonstrated by an RCT by Rubino and Lukes[30] and by a multicenter prospective evaluation by Scheiber and Chen.[33] Focusing instead on outpatient use of HM, Papalona et al.[25,29]—both at the preliminary stage and in their final results—showed that in hysteroscopic polypectomy, HM was significantly faster, achieved a higher success rate for complete polypectomy, and required a shorter learning curve by personnel trained in the management of endometrial polyps compared with bipolar electrical resection.

3.8 | Retained products of conception (RPOC)

Eight studies examined the hysteroscopic morcellator in the treatment of RPOC.[23,28,39,45,49,52,53,56] Hamerlynck et al.[23] conducted a retrospective analysis of 105 cases of RPOC excised by HM, concluding that the latter may be an effective technique for the management of this disease. Equivalent results were obtained by two different prospective cohort studies.[45,56] The same group later carried out an RCT,[28] comparing HM with loop electrosurgical resection for the removal of placental remnants, finding a significant reduction in both operating time and total procedure time for HM. In a follow-up study from the same cohort, the reproductive and obstetric outcomes were evaluated[39]; the authors determined that the hysteroscopic removal of RPOC appears to have no adverse impact on reproductive outcomes and on pregnancy rates.

Evacuation of RPOC using the hysteroscopic morcellator is superior to ultrasound-guided electric vacuum aspiration in terms of the rate of complete removal, as demonstrated by an RCT[52] and a prospective cohort study[53] from Wagenaar et al.

Finally, the hysteroscopic removal of RPOC was associated with a high level of patient satisfaction in the prospective evaluation by Queiruga et al.[49]

Quality of evidence

The evidence regarding the safety, effectiveness, and reliability of employing the hysteroscopic morcellator for the removal of RPOC has been classified as evidence level 2.

4 | DISCUSSION

4.1 | Comparison with existing literature

Hysteroscopic morcellation represents a feasible, safe, rapid, and cost-effective methodology for the treatment of intrauterine pathology. This device is suitable for use in both outpatient and inpatient environments, ensuring an effective execution of the operative procedures. Furthermore, the technical features of the hysteroscopic morcellator enable its application in both the "no-touch" technique and "see-and-treat" procedures. However, it is necessary to have a thorough knowledge of diagnostic hysteroscopy acquired through appropriate training to fully master its potential.[58] The original intrauterine morcellator prototype developed by Smith & Nephew consisted of a 4.5-mm inner instrument, introduced through the straight working channel of a continuous flow 9-mm rigid endoscope; hence, cervical dilatation was required. The further miniaturization of the instruments has allowed the development of a wide range of surgical devices, perfectly compatible with the outpatient setting, without the use of speculum, cervical dilatation, and/or anesthesia. Currently, the most widely used morcellators feature an operative channel in which the actual instrument with rotating blades is inserted and an outer sheath of variable diameter ranging between 5.6 and 6.25 mm.[59] Additionally, new manually activated morcellators have recently been introduced to the market, with extremely reduced diameter, which can easily fit into the working channel of a 5-mm diagnostic hysteroscope.[48,51]

Regarding endometrial polypectomy, the hysteroscopic morcellator has shown a quicker operative time, lower surgical pain, and overall higher patient satisfaction in numerous high-quality studies, compared with traditional electrosurgical resection,[26,27,38] a bipolar electrode such as VersaPoint®[25,29] or electrosurgical snares.[47] In most cases, the structure of the endometrial polyp is of the same consistency as the normal mucosa, allowing for an effective and rapid removal even of large polyps. The results of our systematic review are consistent with the results previously reported by a meta-analysis conducted by Guo et al.[60]

Uterine leiomyomas can be slightly more difficult to excise with cold-knife electromechanical morcellation. Due to the increased presence of collagen fibers and frequent occurrences of intratissue calcification, the fibers of the fibroid are often rigid and difficult to address without the use of electrical energy, as highlighted in the RCT by van Wessel et al.[42] Nevertheless, HM has shown no difference in terms of surgical outcomes compared with traditional resectoscopic techniques or bipolar electrodes, but a significant reduction in the operating time has been demonstrated by several articles.[24,32,42,44] These results are consistent with a meta-analysis conducted by Shazly et al.[61] and a systematic review conducted by Vitale et al.[59] However, it should be emphasized that the data reported in the present study are nothing more than a summary of data from original studies that reported excision of leiomyomas with an average size around 30 mm. Therefore, it would be necessary to define, in the right context, the applicability of HM for larger myomas as well. Future studies should investigate its potential applicability to FIGO (the International Federation of Gynecology & Obstetrics) Type 3 myomas as well.[62–64]

Hysteroscopic morcellation may also be slightly superior to the traditional techniques for evacuation of early miscarriages like

dilatation & curettage or electric vacuum aspiration, because of the possibility of obtaining direct visualization of both the cavity and the RPOC before and after surgery compared with "blind" techniques, which not infrequently lead to incomplete removal of intrauterine material. Recently also, Kelly et al.[65] demonstrated that hysteroscopy with morcellation is a safe diagnostic method for low- and high-grade endometrial pathologic conditions and does not result in increased spread of malignant cells, invasion of the lymphovascular space, or up-staging of patients. Future studies could therefore investigate the application that HM may have in fertility sparing treatment of endometrial cancer, where hysteroscopy is already widely used.[66,67] The only limitation of the morcellation technique, as reported by a recent meta-analysis,[68] may be bleeding, which can limit surgical visibility to the point of sometimes requiring an interruption of the procedure and a second surgical step. However, in the case of leiomyomas, as mentioned above, there may be many limitations. It is necessary to determine the real gain of using HM on large myomas; it is also necessary to define whether this tool can be used to approach submucosal myomas of different classifications and thus not only G0 or G1 for which the application seems almost taken for granted, but especially for G2 or even G3, in which the intramural component represents the major portion if not even the entirety.

4.2 | Strengths and limitations

In this systematic review, we comprehensively evaluated the efficacy, safety, and feasibility of HM in treating intrauterine pathologies based on a thorough search strategy and inclusion of 40 relevant studies.

The descriptive synthesis of results provides valuable insights into its application for specific conditions like endometrial polyps, uterine leiomyomas, and RPOC. The evidence summarized and grouped derives from high-quality publications, as 25 out of the 40 included studies were prospective, including 15 RCTs. Furthermore, in most of the included studies, the control patients underwent the same surgical procedure with different endoscopic instruments still commonly used in daily clinical practice, reflecting the significant advantages of introducing the morcellator in the gynecology departments.

Nevertheless, the lack of quantitative analysis due to data heterogeneity limits the ability to generalize findings. Some studies lacked consistency in reporting outcomes or had varying methodologies, potentially influencing the overall assessment. Additionally, identified limitations such as potential bleeding and the necessity for additional surgical steps in certain cases, underscore the need for careful consideration of patient selection and procedural approach.

4.3 | Implications

The findings suggest that integrating the hysteroscopic morcellator into gynecologic practice could enhance the management of intrauterine pathologies, providing effective and efficient treatment with minimal complications. This may lead to improved patient outcomes and increased adoption of minimally invasive techniques in clinical practice.

However, careful consideration of potential limitations, such as bleeding risks and the need for additional surgical steps, is warranted when implementing this technology. Further research could focus on refining surgical protocols and addressing these challenges to optimize the use of hysteroscopic morcellators in routine clinical care.

AUTHOR CONTRIBUTIONS

VC, SB, AG, and AF were responsible for the acquisition, analysis, and interpretation of the data. AE, AD, and VA were responsible for drafting the work. ASL, CC, and AV were responsible for revising the work critically for important intellectual content. FS, LN, EC, and GR gave final approval of the version to be published. AE and AD agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved. All authors met the International Committee of Medical Journal Editors criteria for authorship and have read and agreed to the current version of the manuscript.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Antonio D'Amato https://orcid.org/0000-0001-6286-761X

REFERENCES

1. Mairos J, Di Martino P. Office hysteroscopy. An operative gold standard technique and an important contribution to patient safety. *Gynecol Surg*. 2016;13:111-114. doi:10.1007/s10397-015-0926-0
2. Revel A, Shushan A. Investigation of the infertile couple: hysteroscopy with endometrial biopsy is the gold standard investigation for abnormal uterine bleeding. *Hum Reprod*. 2002;17:1947-1949. doi:10.1093/humrep/17.8.1947
3. Jiang J. Endometrial polyps. *Am J Obstet Gynecol*. 2022;226:734-735. doi:10.1016/j.ajog.2021.11.013
4. Munro MG, Critchley HOD, Fraser IS, FIGO Menstrual Disorders Committee. The two FIGO systems for normal and abnormal uterine bleeding symptoms and classification of causes of abnormal uterine bleeding in the reproductive years: 2018 revisions. *Int J Gynaecol Obstet*. 2018;143:393-408. doi:10.1002/ijgo.12666
5. Urman B, Yakin K, Ertas S, et al. Fertility and anatomical outcomes following hysteroscopic adhesiolysis: an 11-year retrospective cohort study to validate a new classification system for intrauterine adhesions (Urman-Vitale classification system). *Int J Gynaecol Obstet*. 2023;165:644-654. doi:10.1002/ijgo.15262
6. Vitale SG, Moore O, Riemma G, Carugno J, Yarto ML, Haimovich S. Hysteroscopic laser ablation of symptomatic uterine fibroids:

insights from a prospective study. *Climacteric*. 2023;26:497-502. doi:10.1080/13697137.2023.2205581
7. Vitale SG, Laganà AS, Török P, et al. Virtual sonographic hysteroscopy in assisted reproduction: a retrospective cost-effectiveness analysis. *Int J Gynaecol Obstet*. 2022;156:112-118. doi:10.1002/ijgo.13651
8. Bettocchi S, Nappi L, Ceci O, Selvaggi L. What does "diagnostic hysteroscopy" mean today? The role of the new techniques. *Curr Opin Obstet Gynecol*. 2003;15:303-308. doi:10.1097/01.gco.0000084241.09900.c8
9. Wortman M. "See-and-treat" hysteroscopy in the Management of Endometrial Polyps. *Surg Technol Int*. 2016;28:177-184.
10. Gambadauro P, Martínez-Maestre MA, Torrejón R. When is see-and-treat hysteroscopic polypectomy successful? *Eur J Obstet Gynecol Reprod Biol*. 2014;178:70-73. doi:10.1016/j.ejogrb.2014.03.048
11. Etrusco A, Laganà AS, Chiantera V, et al. Efficacy, safety, and feasibility of the treatment of intrauterine pathologies with the mini-resectoscope: a systematic review. *Int J Gynaecol Obstet*. 2024;166:527-537. doi:10.1002/ijgo.15393
12. Etrusco A, Buzzaccarini G, Laganà AS, et al. Use of diode laser in hysteroscopy for the Management of Intrauterine Pathology: a systematic review. *Diagnostics (Basel)*. 2024;14:327. doi:10.3390/diagnostics14030327
13. De Silva PM, Stevenson H, Smith PP, Clark TJ. Pain and operative technologies used in office hysteroscopy: a systematic review of randomized controlled trials. *J Minim Invasive Gynecol*. 2021;28:1699-1711. doi:10.1016/j.jmig.2021.05.018
14. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71
15. Cumpston M, Li T, Page MJ, et al. Updated guidance for trusted systematic reviews: a new edition of the Cochrane handbook for systematic reviews of interventions. *Cochrane Database Syst Rev*. 2019;10:ED000142. doi:10.1002/14651858.ED000142
16. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol*. 2010;25:603-605. doi:10.1007/s10654-010-9491-z
17. Home. The Centre for Evidence-Based Medicine. 2020 Accessed January 20, 2024. https://www.cebm.net/.
18. Emanuel MH, Wamsteker K. The intra uterine morcellator: a new hysteroscopic operating technique to remove intrauterine polyps and myomas. *J Minim Invasive Gynecol*. 2005;12:62-66. doi:10.1016/j.jmig.2004.12.011
19. van Dongen H, Emanuel MH, Wolterbeek R, Trimbos JB, Jansen FW. Hysteroscopic morcellator for removal of intrauterine polyps and myomas: a randomized controlled pilot study among residents in training. *J Minim Invasive Gynecol*. 2008;15:466-471. doi:10.1016/j.jmig.2008.02.002
20. Hamerlynck TWO, Dietz V, Schoot BC. Clinical implementation of the hysteroscopic morcellator for removal of intrauterine myomas and polyps. A retrospective descriptive study. *Gynecol Surg*. 2011;8:193-196. doi:10.1007/s10397-010-0627-7
21. Yong J, Guo X, Lan H, et al. Clinical analysis of the MyoSure hysteroscopic tissue removal system of endometrial polyps in women with an intact hymen. *BMC Womens Health*. 2021;21:214. doi:10.1186/s12905-021-01362-w
22. AlHilli MM, Nixon KE, Hopkins MR, Weaver AL, Laughlin-Tommaso SK, Famuyide AO. Long-term outcomes after intrauterine morcellation vs hysteroscopic resection of endometrial polyps. *J Minim Invasive Gynecol*. 2013;20:215-221. doi:10.1016/j.jmig.2012.10.013
23. Hamerlynck TWO, Blikkendaal MD, Schoot BC, Hanstede MMF, Jansen FW. An alternative approach for removal of placental remnants: hysteroscopic morcellation. *J Minim Invasive Gynecol*. 2013;20:796-802. doi:10.1016/j.jmig.2013.04.024
24. Bigatti G, Franchetti S, Rosales M, Baglioni A, Bianchi S. Hysteroscopic myomectomy with the IBS® integrated Bigatti shaver versus conventional bipolar resectoscope: a retrospective comparative study. *Gynecol Surg*. 2014;11:9-18. doi:10.1007/s10397-013-0827-z
25. Pampalona JR, Bastos MD, Moreno GM, et al. A comparison of hysteroscopic mechanical tissue removal with bipolar electrical resection for the management of endometrial polyps in an ambulatory care setting: preliminary results. *J Minim Invasive Gynecol*. 2015;22:439-445. doi:10.1016/j.jmig.2014.12.004
26. Smith PP, Middleton LJ, Connor M, Clark TJ. Hysteroscopic morcellation compared with electrical resection of endometrial polyps: a randomized controlled trial. *Obstet Gynecol*. 2014;123:745-751. doi:10.1097/AOG.0000000000000187
27. Hamerlynck TWO, Schoot BC, van Vliet HAAM, Weyers S. Removal of endometrial polyps: hysteroscopic morcellation versus bipolar Resectoscopy, a randomized trial. *J Minim Invasive Gynecol*. 2015;22:1237-1243. doi:10.1016/j.jmig.2015.07.006
28. Hamerlynck TWO, van Vliet HAAM, Beerens A-S, Weyers S, Schoot BC. Hysteroscopic morcellation versus loop resection for removal of placental remnants: a randomized trial. *J Minim Invasive Gynecol*. 2016;23:1172-1180. doi:10.1016/j.jmig.2016.08.828
29. Rovira Pampalona J, Degollada Bastos M, Mancebo Moreno G, et al. Outpatient hysteroscopic polypectomy: bipolar energy system (Versapoint®) versus mechanical energy system (TRUCLEAR system®) - preliminary results. *Gynecol Obstet Investig*. 2015;80:3-9. doi:10.1159/000377700
30. Rubino RJ, Lukes AS. Twelve-month outcomes for patients undergoing hysteroscopic morcellation of uterine polyps and myomas in an office or ambulatory surgical center. *J Minim Invasive Gynecol*. 2015;22:285-290. doi:10.1016/j.jmig.2014.10.015
31. Arnold A, Ketheeswaran A, Bhatti M, Nesbitt-Hawes E, Abbott J. A prospective analysis of hysteroscopic morcellation in the management of intrauterine pathologies. *J Minim Invasive Gynecol*. 2016;23:435-441. doi:10.1016/j.jmig.2016.01.013
32. Lee MMH, Matsuzono T. Hysteroscopic intrauterine morcellation of submucosal fibroids: preliminary results in Hong Kong and comparisons with conventional hysteroscopic monopolar loop resection. *Hong Kong Med J*. 2016;22:56-61. doi:10.12809/hkmj154600
33. Scheiber MD, Chen SH. A prospective multicenter registry of patients undergoing hysteroscopic morcellation of uterine polyps and myomas. *J Gynecol Surg*. 2016;32:318-323. doi:10.1089/gyn.2016.0008
34. Liang Y, Ren Y, Wan Z, et al. Clinical evaluation of improved MyoSure hysteroscopic tissue removal system for the resection of type II submucosal myomas. *Medicine (Baltimore)*. 2017;96:e9363. doi:10.1097/MD.0000000000009363
35. Ceci O, Franchini M, Cannone R, et al. Office treatment of large endometrial polyps using truclear 5C: feasibility and acceptability. *J Obstet Gynaecol Res*. 2019;45:626-633. doi:10.1111/jog.13874
36. Georgiou D, Tranoulis A, Jackson TL. Hysteroscopic tissue removal system (MyoSure) for the resection of polyps, sub-mucosal leiomyomas and retained products of conception in an out-patient setting: a single UK institution experience. *Eur J Obstet Gynecol Reprod Biol*. 2018;231:147-151. doi:10.1016/j.ejogrb.2018.10.030
37. Maheux-Lacroix S, Mennen J, Arnold A, et al. The need for further surgical intervention following primary hysteroscopic morcellation of submucosal leiomyomas in women with abnormal uterine bleeding. *Aust N Z J Obstet Gynaecol*. 2018;58:570-575. doi:10.1111/ajo.12781
38. Tsuchiya A, Komatsu Y, Matsuyama R, Tsuchiya H, Takemura Y, Nishii O. Intraoperative and postoperative clinical evaluation of the hysteroscopic morcellator system for endometrial polypectomy: a prospective, randomized, single-blind, parallel group comparison study. *Gynecol Minim Invasive Ther*. 2018;7:16-21. doi:10.4103/GMIT.GMIT_6_17
39. van Wessel S, Coryn N, van Vliet H, Schoot B, Weyers S, Hamerlynck T. Reproductive and obstetric outcomes after hysteroscopic removal of retained products of conception. *J Minim Invasive Gynecol*. 2020;27:840-846. doi:10.1016/j.jmig.2019.07.016
40. Ceci O, Franchini M, Cardinale S, et al. Comparison of endometrial polyp recurrence in fertile women after office hysteroscopic

endometrial polypectomy using two widely spread techniques. *J Obstet Gynaecol Res*. 2020;46:2084-2091. doi:10.1111/jog.14400

41. Stoll F, Lecointre L, Meyer N, et al. Randomized study comparing a reusable morcellator with a resectoscope in the hysteroscopic treatment of uterine polyps: the RESMO study. *J Minim Invasive Gynecol*. 2021;28:801-810. doi:10.1016/j.jmig.2020.07.007
42. van Wessel S, van Vliet HAAM, Schoot BC, Weyers S, Hamerlynck TWO. Hysteroscopic morcellation versus bipolar resection for removal of type 0 and 1 submucous myomas: a randomized trial. *Eur J Obstet Gynecol Reprod Biol*. 2021;259:32-37. doi:10.1016/j.ejogrb.2021.01.050
43. Kavoussi SK, Esqueda AS, West BT, et al. The effects of hysteroscopic morcellation of endometrial polyps on frozen embryo transfer outcomes. *Eur J Obstet Gynecol Reprod Biol*. 2021;267:241-244. doi:10.1016/j.ejogrb.2021.11.420
44. Valero I, García-Jiménez R, Florez N, Weber-Fernandez AM, Oña López MR, Lara MD. Mini-resectoscope vs morcellator for in-office hysteroscopic myomectomy: evaluation of results and patient satisfaction. *Eur J Obstet Gynecol Reprod Biol*. 2022;270:95-99. doi:10.1016/j.ejogrb.2021.12.039
45. Weinberg S, Pansky M, Burshtein I, Beller U, Goldstein H, Barel O. A pilot study of guided conservative hysteroscopic evacuation of early miscarriage. *J Minim Invasive Gynecol*. 2021;28:1860-1867. doi:10.1016/j.jmig.2021.04.017
46. Bhagat N, Pappala S, Chattopadhyay P, Das S. Evaluation of the safety and efficacy of resection of endometrial polyps and submucosal fibroids in an outpatient setting in a large district general hospital in the UK. *J Midlife Health*. 2022;13:133-138. doi:10.4103/jmh.jmh_154_21
47. van Gemert J, Herman MC, Beelen P, Geomini PM, Bongers MY. Endometrial polypectomy using tissue removal device or electrosurgical snare: a randomised controlled trial. *Facts Views Vis Obgyn*. 2022;14:235-243. doi:10.52054/FVVO.14.3.035
48. van Wessel S, Hamerlynck T, van Vliet H, Schoot B, Weyers S. Manual morcellation (Resectr™ 9Fr) vs electromechanical morcellation (TruClear™) for hysteroscopic polypectomy: a randomized controlled non-inferiority trial. *Acta Obstet Gynecol Scand*. 2023;102:209-217. doi:10.1111/aogs.14493
49. Bailón Queiruga M, Olivé LM, Redol AC, Trigo CA, Betbesé EM, González MS. Outpatient hysteroscopic removal of retained products of conception: evaluation of effectiveness, safety and patient satisfaction. *Eur J Obstet Gynecol Reprod Biol*. 2023;290:123-127. doi:10.1016/j.ejogrb.2023.09.022
50. Tam T, Juarez L. Effectiveness of a hysteroscopic tissue removal system device for hysteroscopic myomectomy on patients' quality of life: a randomized clinical trial. *BMC Womens Health*. 2023;23:541. doi:10.1186/s12905-023-02707-3
51. van Wessel S, Hamerlynck T, van Vliet H, Weyers S, Schoot B. Clinical evaluation of a new hand-driven hysteroscopic tissue removal device, Resectr™ 5fr, for the resection of endometrial polyps in an office setting. *Arch Gynecol Obstet*. 2023;308:893-900. doi:10.1007/s00404-023-06995-w
52. Wagenaar LP, Hamerlynck TW, Radder CM, et al. Hysteroscopic morcellation vs. curettage for removal of retained products of conception: a multicenter randomized controlled trial. *Fertil Steril*. 2023;120:1243-1251. doi:10.1016/j.fertnstert.2023.08.956
53. Wagenaar LP, van Vliet HA, Radder CM, et al. Operative hysteroscopy versus ultrasound-guided electric vacuum aspiration for removal of retained products of conception: a prospective cohort study. *Eur J Obstet Gynecol Reprod Biol X*. 2023;20:100230. doi:10.1016/j.eurox.2023.100230
54. Yong J, Wan Y, Ye M, et al. Comparative analysis of the clinical efficacy and reproductive outcomes of the hysteroscopic tissue removal system (MyoSure) and hysteroscopic electroresection in the treatment of benign intrauterine lesions. *Int J Gynaecol Obstet*. 2023;163:115-122. doi:10.1002/ijgo.14863
55. Zhang S, Di W, Wang Y, et al. Hysteroscopic myomectomy with the IBS® intrauterine Bigatti shaver: a retrospective comparative analysis of the impact of rotational speed and aspiration flow rate. *Facts Views Vis Obgyn*. 2023;15(53–9):53-59. doi:10.52054/FVVO.15.1.063
56. Damiani GR, Di Gennaro D, Vimercati A, et al. Office intrauterine morcellation for retained products of conception. *Minim Invasive Ther Allied Technol*. 2023;32:323-328. doi:10.1080/13645706.2023.2227694
57. Darwish A. Modified hysteroscopic myomectomy of large submucous fibroids. *Gynecol Obstet Investig*. 2003;56:192-196. doi:10.1159/000074451
58. Mazzon I, Etrusco A, Laganà AS, et al. Training in diagnostic hysteroscopy: the "arbor vitae" method. *Medicina (Kaunas)*. 2023;59:1019. doi:10.3390/medicina59061019
59. Vitale SG, Sapia F, Rapisarda AMC, et al. Hysteroscopic morcellation of submucous myomas: a systematic review. *Biomed Res Int*. 2017;2017:6848250. doi:10.1155/2017/6848250
60. Guo T, Zhou H, Yang J, et al. Identifying the superior surgical procedure for endometrial polypectomy: a network meta-analysis. *Int J Surg*. 2019;62:28-33. doi:10.1016/j.ijsu.2019.01.003
61. Shazly SAM, Laughlin-Tommaso SK, Breitkopf DM, et al. Hysteroscopic morcellation versus resection for the treatment of uterine cavitary lesions: a systematic review and meta-analysis. *J Minim Invasive Gynecol*. 2016;23:867-877. doi:10.1016/j.jmig.2016.04.013
62. Etrusco A, Laganà AS, Chiantera V, et al. Feasibility and surgical outcomes of hysteroscopic myomectomy of FIGO type 3 myoma: a systematic review. *J Clin Med*. 2023;12:4953. doi:10.3390/jcm12154953
63. Favilli A, Mazzon I, Etrusco A, et al. The challenge of FIGO type 3 leiomyomas and infertility: exploring therapeutic alternatives amidst limited scientific certainties. *Int J Gynaecol Obstet*. 2023;165:975-987. doi:10.1002/ijgo.15260
64. Favilli A, Etrusco A, Chiantera V, et al. Impact of FIGO type 3 uterine fibroids on in vitro fertilization outcomes: a systematic review and meta-analysis. *Int J Gynaecol Obstet*. 2023;163:528-539. doi:10.1002/ijgo.14838
65. Kelly RA, Contos GT, Walker CA, Ayoola-Adeola M, Kim S, Winer IS. Hysteroscopic morcellation in endometrial cancer diagnosis: increased risk? *J Minim Invasive Gynecol*. 2021;28:1625-1632. doi:10.1016/j.jmig.2021.02.004
66. Etrusco A, Laganà AS, Chiantera V, et al. Reproductive and oncologic outcomes in young women with stage IA and grade 2 endometrial carcinoma undergoing fertility-sparing treatment: a systematic review. *Biomolecules*. 2024;14:306. doi:10.3390/biom14030306
67. Gullo G, Etrusco A, Cucinella G, et al. Fertility-sparing approach in women affected by stage I and low-grade endometrial carcinoma: an updated overview. *Int J Mol Sci*. 2021;22:11825. doi:10.3390/ijms222111825
68. Ren F, Huang G, Wang X, Li X, Cai J. Comparison of hysteroscopic morcellation versus Resectoscopy in treatment of patients with endometrial lesions: a meta-analysis. *Med Sci Monit*. 2022;28(e936771):e936771. doi:10.12659/MSM.936771

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Etrusco A, Agrifoglio V, Chiantera V, et al. Efficacy, safety, and feasibility of the treatment of intrauterine pathologies with the hysteroscopic morcellator: A systematic review. *Int J Gynecol Obstet*. 2025;00:1-15. doi:10.1002/ijgo.70347