Wang et al. BMC Surgery (2025) 25:128
https://doi.org/10.1186/s12893-025-02857-1

BMC Surgery

RESEARCH

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No differences in IVF pregnancy outcomes following hysteroscopic polypectomy using a manual hysteroscopic tissue removal device versus conventional resection

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Abstract

Background To compare in-vitro fertilization and embryo transfer (IVF-ET) pregnancy outcomes following endometrial polypectomy using either a manual mechanical hysteroscopic tissue resection device (mHTR) or traditional mechanical resection with scissors or polyp graspers resection.

Methods This retrospective study examined 189 infertile patients who had undergone polypectomy prior to IVF-ET at Reproductive and Genetic Hospital of CITIC-XIANGYA. Patients undergoing polypectomy using manual mHTR resection were compared to those having the procedure through traditional mechanical resection. The primary outcome was clinical pregnancy rate (CPR) following the first ET after hysteroscopic polypectomy. Secondary outcomes included miscarriage rates and the optimal time interval from polyp resection to ET.

Results One-hundred eleven (58.7%) patients underwent polypectomy via manual mHTR while 78 (41.3%) patients underwent traditional mechanical resection for polypectomy. Following the first ET, the positive pregnancy rate (80.2% vs. 79.5%; $p = 1.000$), CPR (70.3% vs. 74.4%; $p = 0.652$), and MR (11.5% vs. 12.1%; $p = 1.000$) were similar between those undergoing mHTR and traditional mechanical resection. After stratifying by the number of menstrual cycles from procedure (after next menses; 2 to 3 menstrual cycles; and > 3 menstrual cycles later), there was no differences in CPR when comparing the time from polypectomy and resection type.

Conclusion This study suggests no differences in IVF pregnancy outcomes following hysteroscopic polypectomy regardless of surgical type using manual mHTR or traditional mechanical resection and the timing from resection.

Keywords Endometrial polyps, Hysteroscopy, Manual mechanical tissue resection device, Traditional mechanical resection, In-vitro fertilization, Clinical pregnancy rate

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Introduction

Endometrial polyps (EPs), focal intrauterine lesions typically observed in women of reproductive age, may exhibit no symptoms or trigger issues like abnormal uterine bleeding [1] and infertility. Notably, EPs are prevalent in up to 35% of infertile women [2–4] though some estimates are slightly lower prior to in vitro fertilization and embryo transfer (IVF-ET), ranging from 6 to 32% of women [5–7].

Though controversial, previous research has hinted that the resection of EPs may contribute to enhanced natural conception rates, as well as improving outcomes with assisted reproductive techniques [7–9]. continues to be the gold standard in diagnosing and treating intrauterine lesions including EPs [10]. Surgical options include the use of traditional mechanical resection with polyp graspers or scissors, electro-resection using monopolar or bipolar current [11–13], loop snares [14], and electro-mechanical hysteroscopic tissue resection devices (mHTR) [15–17].

The widespread adoption of mHTR is attributed to its high efficiency, safety, and user-friendliness in managing endometrial pathology, both in the operating room and office settings [15, 16]. This technique employs mechanical energy to eliminate lesions via a high-speed rotating and reciprocating blade within a cutting window, concurrently evacuating tissue fragments through a negative pressure suction system attached to the handle [18]. However, despite widespread clinical application for several years, costs associated with single-use components have limited its application universally.

More recently, lower cost disposable manual mHTR have been introduced into clinical practice with approval to resect and remove retained products of conception and EPs. These manual mHTR are compatible with hysteroscopes that feature a 3.0 mm (9Fr) straight instrument channel. Additionally, they have a hand-held trigger, obviating the need for an electrically powered control unit.

Given the current evidence suggesting the benefits of EP resection prior to assisted reproduction, but the lack of evidence as to the optimal surgical approach in removal, we retrospectively compared IVF-ET pregnancy outcomes between mHTR to traditional mechanical resection in hysteroscopic polypectomy, as well as the ideal time gap between EP resection and ET.

Methods

Ethical approval

This retrospective cohort study was approved the ethics committee of Reproductive and Genetic Hospital of CITIC-XIANGYA (Number LL-SC-2023-034) and conducted in adherence to privacy act guidelines.

Study population

Between January 2022 and March 2023, subjects who were diagnosed with uterine polyps using 3D ultrasound or diagnostic hysteroscopy and who underwent hysteroscopic polypectomy at the Reproductive and Genetic Hospital of CITIC-XIANGYA with a follow-up period of at least 1 year were evaluated. Patients with a polyp > 1 cm and/or ≥ 6 polyps underwent surgery in the operating room, while all others were given the option of the operating room or office setting. All other cases were performed in the outpatient setting with only traditional mechanical resection. From January 2022 to May 2022, traditional mechanical resection was performed while cases from June 2022 to March 2023 were performed using the manual mHTR.

Histopathologic diagnosis of EP at hysteroscopy was a necessary condition for inclusion. Exclusion criteria were applied to participants who had not undergone ET following EP excision ($n = 27$); those with congenital malformations ($n = 9$); those diagnosed with endometrial tuberculosis ($n = 1$); and individuals over 45 years of age($n = 3$).

Surgical procedure

All procedures, executed during the follicular phase of the menstrual cycle, were precisely handled by seasoned surgeons (HC, YD, HML, YSY and QMW) in the operating room of the Reproductive and Genetic Hospital of CITIC-XIANGYA. Initially, cervical dilation was performed, subsequently followed by the insertion of either a 6.5 mm 30° hysteroscope with a 7Fr instrument working channel (Olympus, Tokyo, Japan) or a 6.5 mm 12° OriScope hysteroscope equipped with a 9Fr instrument working channel (OriGyn Medical, Hangzhou, China), which were used to ascertain the location, size, and relationship of EPs with the surrounding tissues.

Those in the traditional mechanical resection group had endometrial polyps performed using graspers or scissors (Olympus, Tokyo, Japan) inserted into the working channel of hysteroscope to grab or cut the root pedicle of the polyps in the standard fashion.

In manual mHTR group, the OriScope hysteroscope was combined with the PolyGone® (OriGyn Medical, Hangzhou, China) system for resection. Activation of the mHTR (PolyGone®) was by initiated by squeezing the manual trigger. A rotation knob empowers the physician to align the cutting bay with the targeted specimen by rotating the cutting bay into the desired orientation. The end of the handle provides a connection port for the vacuum system, which pulls the specimen into the cutting window, where it is removed and sucked out of the uterus (Fig. 1). Complete polypectomy refers to the comprehensive removal and retrieval of all visually identifiable polyp tissue, whether single or multiple, ensuring the absence

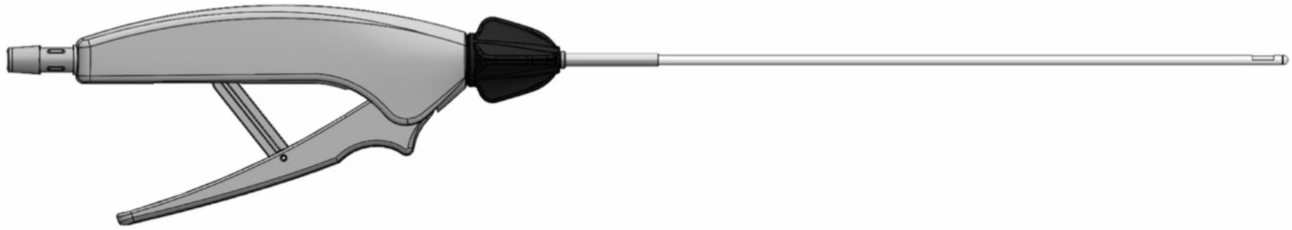

Fig. 1 Polygon mHTR Device

of any residual polyp remnants within the uterine cavity under hysteroscopic observation [19]. No post-operative adjuvants including intrauterine balloon device or estrogens were used. All endometrial polyps were confirmed histologically.

Clinical and laboratory protocols

IVF was initiated either prior or after hysteroscopic polypectomy. Controlled ovarian stimulation (COS) was included ultra long- agonist ($n = 52$), long-agonist ($n = 56$), antagonist ($n = 42$) and progestin primed ovarian stimulation (PPOS) ($n = 39$) and was determined at the physician discretion.

In the long-agonist protocol, 1.5 mg of GnRH analog (Leuprorelin, Lizhu, China) is administered in the mid-luteal phase. Gonadotropin (Gn) therapy commences post-desensitization, with dosage tailored to patient characteristics and ovarian response. Daily administration of Recombinant FSH(Gensci, ChangChun, China) or human menopausal gonadotropins (hMG, Lizhu, China; Menopur, Ferring GmbH, Wittland, Germany) continues until hCG injection. In the Ultra long-agonist protocol, Leuprorelin (Lizhu, China) is given initially in the mid-luteal phase and repeated 28 days later. Post-desensitization, hMG (Lizhu, China; Menopur, Germany), is administered daily until hCG injection. In the antagonist protocol, recombinant FSH (Gensci, China) is administered daily from Day 2–3, with 0.25 mg of Cetrotide (Merck-Serono, Geneva, Switzerland) given daily once the lead follicle reaches 12 mm, continuing until hCG injection. In the PPOS protocol, dydrogesterone (10 mg/12 hours) and recombinant FSH (Gensci, China) are used from Day 2–3, until hCG administration. 5000–10,000 IU hCG (Lizhu, China) is administered when at least three follicles reach 17 mm, followed by transvaginal oocyte retrieval 34–36 h later.

One or two embryos were transferred transcervically, guided by ultrasound, using a Wallace catheter (Cooper Surgical, Trumball, CT, USA). The luteal phase support was provided via vaginal progesterone gel (90 mg daily, Crinone, Merck-Serono, Geneva, Switzerland) starting the day after the retreval. luteal phase support until 28–35 days following ET.

Embryo vitrification, thawing and transfer

In the event that endometrial lesions were detected prior to ET, embryos were cryopreserved.

The Kitazato vitrification kit (Kitazato Biopharma, Shizuoka, Japan) and High Security Vitrification Straws (Cryo Bio System, France) were used for embryo vitrification and thawing.

Endometrial Preparation before frozen embryo transfer

The choice between natural or programmed endometrial preparation (natural, GnRH-agonist down-regulation-hormone replacement cycle [HRC], or HRC alone) was guided by physician and patient preference. In the natural cycle, dydrogesterone (Duphaston, Abbott Biologicals B.V., The Netherlands) supported the luteal phase after ovulation. The HRC group took oral estradiol valerate (Progynova, Delpharm Lille SAS, France) in a fixed or incremental dose, starting on day 3 of a natural or progesterone-induced cycle. A transvaginal ultrasound assessed endometrial thickness 10–15 days later. Once it reached ≥ 8 mm, dydrogesterone (Duphaston) and Utrogestan (Laboratoires Besins International, France) were administered orally and vaginally for luteal phase support until week 10 of pregnancy.ET was carried out either 4 days f after dedrogesterone and progesterone were given to day 3 embryos or 6 days after blastocysts were given. ETs were performed with the use of a Wallace catheter (CooperSurgical, Trumball, CT, USA) 1 cm below the uterine fundus under ultrasound guidance.

Outcome measures

Data pertaining to baseline demographic characteristics, cycle stimulation details, and embryology parameters were gathered from patients' medical records and summarized in Tables 1 and 2. The clinical outcomes assessed encompassed pregnancy metrics of the initial ET post-surgery, encompassing the positive pregnancy rate (PR), defined as a serum β-hCG level exceeding 7 mIU/ml per ET, the clinical pregnancy rate (CPR), reflecting the number of intrauterine gestations exhibiting fetal cardiac activity per ET, and the miscarriage rate (MR), signifying any pregnancy loss following intrauterine gestation visualization. Additionally, a sub-analysis was conducted to delve into whether the elapsed time between the type

Table 1 Baseline demographic and operative characteristics

Variables	mHTR	Traditional Mechanical Resection	P-value
	***N*=111**	***N*=78**	
Age	33.1 ± 4.16	31.6 ± 3.86	0.010
Gravidity	0.95 ± 1.24	0.65 ± 0.92	0.155
Parity	0.31 ± 0.58	0.13 ± 0.37	0.018
BMI kg/m^2	22.1 ± 3.05	21.9 ± 2.87	0.835
day 2–3 FSH mIU/mL	6.49 ± 2.16	6.70 ± 2.11	0.223
day 2–3 Estradiol	50.6 ± 96.6	42.5 ± 31.8	0.725
Primary infertility	54 (48.6%)	44 (56.4%)	0.366
Secondary infertility	57 (51.4%)	34 (43.6%)	
Duration of infertility	4.19 ± 3.05	4.04 ± 2.69	0.931
Tubal factor	98 (88.3%)	62 (79.5%)	0.148
Endometriosis	12 (10.8%)	5 (6.41%)	0.434
Ovulatory dysfunction	12 (10.8%)	11 (14.1%)	0.649
Male factor	31 (27.9%)	26 (33.3%)	0.525
Intramural myoma	18 (16.2%)	19 (24.4%)	0.229
Adenomyosis	21 (18.9%)	16 (20.5%)	0.932
Recurrent miscarriage	5 (4.50%)	1 (1.28%)	0.403
Other	12 (10.8%)	4 (5.13%)	0.264
Total number of polyps	6.73 ± 2.74	6.69 ± 3.51	0.733
Maximal polyp size	0.98 ± 0.33	1.02 ± 0.33	0.438

of hysteroscopic polypectomy and ET had any significant impact on the cycle outcomes.

Statistical analysis

To determine the necessary sample size, we employed the standard power calculation methodology tailored for non-inferiority trials and assumed that the CPR for the intervention group (mHTR) was 0.71 [20], and the CPR of the traditional mechanical resection group was 0.56 [21] with a non-inferiority margin 7%. The calculated sample size thus required 75 patients in each surgically treated group (α:0.025 and β:0.80).

Statistical analyses were carried out utilizing R version 4.3.1 (R Core Team, Vienna, Austria). The normality of continuous variables was verified, and they were presented as mean ± SD. Categorical variables were were presented in the form of percentages of n (%). Initially, patients were classified into groups based on mHTR and traditional mechanical resection. Subsequently, these groups were further further subdivided based on the time gap between hysteroscopic polypectomy and the ET cycle.

Specifically, Group 1 comprised patients who underwent ET immediately after their subsequent menstrual cycle, Group 2 did so after a lapse of two or three menstrual cycles, and Group 3 after a period exceeding three menstrual cycles.

To assess the differences between categorical variables, Chi-squared test or Fisher's exact test were employed for comparison. For continuous variables, the t-test, Mann-Whitney U test, or ANOVA were appropriately selected are appropriately selected according to their distribution characteristics. An alpha level of 0.05, utilizing a two-sided approach, was deemed statistically significant in our analysis.

Results

The inclusion of patients in the analysis is illustrated in Fig. 2. In total, 229 were evaluated during the study period with 40 that were excluded resulting 189 patients who were considered for analysis including 111 who under an ET after being treated with the manual mHTR resection and 78 treated with traditional mechanical resection (Fig. 2).

Table 1 outlines an overview of the baseline demographic and operative attributes of the study participants. Those undergoing manual mHTR resection were significantly older (33.1 vs. 31.6 years, $p = 0.010$) and higher parity (0.31 vs. 0.13, $p = 0.018$). No intra or post-operative complications were noted in each group.

Ovarian stimulation and embryological parameters for the study cohort are listed as shown in Table 2. As evident from the table, both surgically treated groups exhibited comparable ovarian stimulation characteristics and embryo quality. Overall, PR (80.2% vs. 79.5%, $p = 1.00$), CPR (70.3% vs. 74.4%, $p = 0.652$), and MR (11.5% vs. 12.1%, $p = 1.000$) were similar (Fig. 3).

Table 3 provides an in-depth comparison of the pregnancy outcomes of ET cycles for patients who underwent hysteroscopic polypectomy, utilizing mHTR and conventional mechanical resection methods. This comparison is stratified based on the number of menstrual cycles following the procedure, encompassing those after the next menses, after 2 to 3 menstrual cycles, and over 3 menstrual cycles. Notably, the average number of embryos transferred remained similar across all groups. Seventy-eight patients underwent ET in the very first menstrual cycle after hysteroscopic polypectomy. There was no difference in PR (80.6% vs. 83%, $p = 1.000$), CPR (74.2% vs. 66%, $p = 0.466$), MR (13.0% vs. 12.9%, $p = 1.000$) when comparing mHTR ($n = 47$) and traditional mechanical resection ($n = 31$). Fifty-one patients underwent ET 2–3 menstrual cycles after polypectomy, and there was no difference in PR (84% vs. 65.4%, $p = 0.199$), CPR (84.0% vs. 61.5%, $p = 0.116$), MR (9.52% vs. 18.8%, $p = 0.634$) when mHTR ($n = 26$) or traditional mechanical resection ($n = 25$) was compared. Finally, sixty patients underwent ET > 3 menstrual cycles after polypectomy; no difference in PR (72.7% vs. 86.8%, $p = 0.189$), CPR (63.6% vs. 81.6%, $p = 0.137$), MR (14.3% vs. 6.45%, $p = 0.578$) was observed after mHTR ($n = 38$) or traditional mechanical resection ($n = 22$).

Table 2 Cycle stimulation and embryology outcomes

Variables	mHTR	Traditional Mechanical Resection	*p*-value
	***N*=111**	***N*=78**	
Cycle stimulation information			
Cycle stimulation protocol			0.193
ultra long- agonist	24(21.6%)	28(35.9%)	
long-agonist	24(21.6%)	21(26.9%)	
antagonist	27(24.3%)	15(19.2%)	
PPOS	25(22.5%)	14(17.9%)	
Peak Estradiol (pg/mL)	3288 ± 1466	3533 ± 1597	0.294
Total Gonadotropin Dose	2374 ± 959	2485 ± 884	0.313
# Oocytes Retrieved	12.2 ± 6.07	12.5 ± 5.28	0.500
# M2 Oocytes retrieved	10.5 ± 4.93	10.6 ± 4.41	0.804
% Fertilized	0.79 ± 0.17	0.78 ± 0.20	0.899
# high-quality embryo	4.42 ± 3.2	4.68 ± 3.61	0.924
% Freeze all	71 (64.0%)	47 (60.3%)	0.715
% with Supernumery Embryos	108 (98.2%)	77 (98.7%)	1.000
First Embryo Transfer Cycle			
Mean # high-quality embryo transferred	1.07 ± 0.81	1.04 ± 0.80	0.771
# high-quality embryo transferred			0.925
0	32 (28.8%)	23 (29.5%)	
1	39 (35.1%)	29 (37.2%)	
2	40 (36.0%)	26 (33.3%)	
Mean # embryos transferred	1.55 ± 0.50	1.56 ± 0.50	0.843
Fresh	1.82 ± 0.39	1.63 ± 0.49	0.090
Frozen	1.82 ± 0.39	1.53 ± 0.50	0.265
Type of transferred embryo			0.564
Fresh embryo	34 (30.6%)	27 (34.6%)	
Frozen embryo	77 (69.4%)	51 (65.4%)	
Endometrial thickness (mm)	13.5 ± 2.18	13.2 ± 2.21	0.426

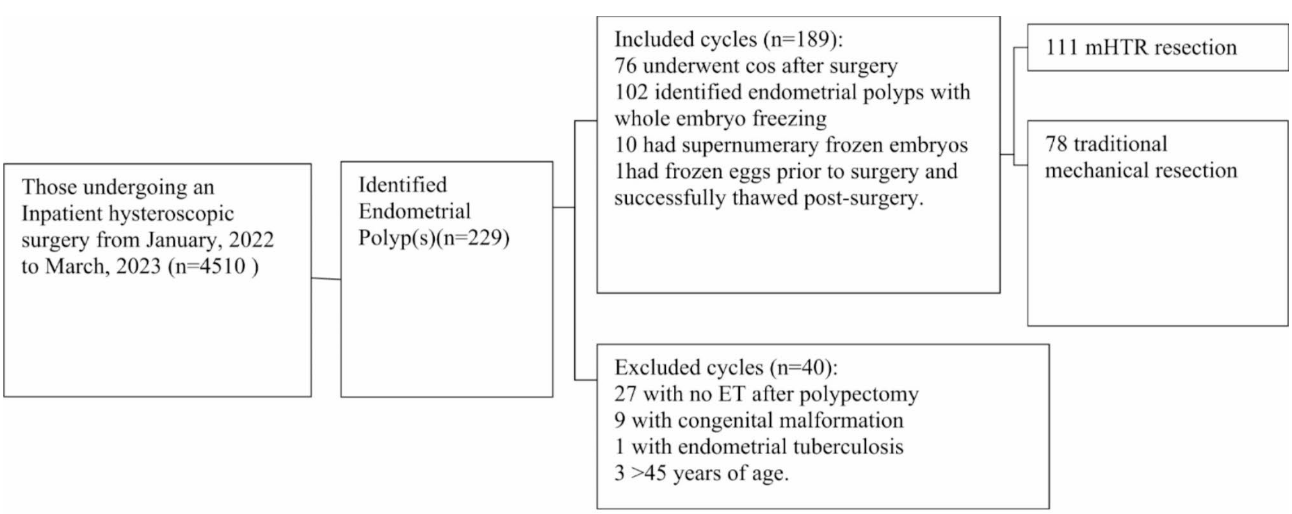

Fig. 2 Flow diagram of cycles included and excluded from the analysis

Discussion

Our results show CPR to be similar when using manual mHTR or traditional mechanical resection for hysteroscopic polypectomy. After stratifying by the number of menstrual cycles from procedure (after next menses; 2 to 3 menstrual cycles; and > 3 menstrual cycles later), there was no differences in CPR when comparing the time from polypectomy and resection type.

Endometrial polyps are typically benign growths that arise in the endometrium of women of reproductive age.

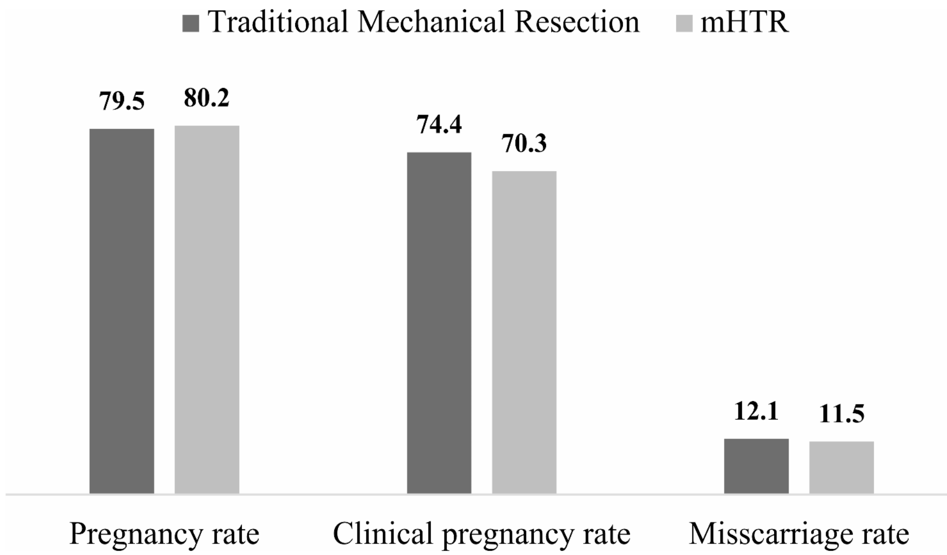

Fig. 3 Pregnancy outcomes of IVF-ET cycles of patients undergoing IVF cycles after manual mHTR and traditional mechanical resection

Table 3 Pregnancy outcomes of IVF-ET cycles of patients after hysteroscopic polypectomy, stratified by groups without distinguishing between fresh or cryopreserved embryos (Those who underwent ET after their next menses, ET after two or three menstrual cycles, and ET after more than three menstrual cycles) using either mHTR or traditional mechanical resection

	ET after Next menses			ET after 2 to 3 menstrual cycles			ET > 3 menstrual cycles		
	Traditional mechanical resection	mHTR	p	Traditional mechanical resection	mHTR	p	Traditional mechanical resection	mHTR	p
	N = 31	*N* = 47		*N* = 25	*N* = 26		*N* = 22	*N* = 38	
Mean number of ET	1.48 ± 0.51	1.53 ± 0.50	0.794	1.60 ± 0.50	1.65 ± 0.49	0.131	1.64 ± 0.49	1.50 ± 0.51	0.177
PR	25(80.6%)	39(83.0%)	1.000	21 (84.0%)	17 (65.4%)	0.199	16(72.7%)	33(86.8%)	0.189
CPR	23(74.2%)	31(66.0%)	0.466	21 (84.0%)	16 (61.5%)	0.116	14(63.6%)	31(81.6%)	0.137
MR	3 (13.0%)	4 (12.9%)	1.000	2 (9.52%)	3 (18.8%)	0.634	2 (14.3%)	2 (6.45%)	0.578

They are particularly prevalent among infertile women, with a prevalence as high as 32% in a report of 1000 women who underwent hysteroscopic examination of the uterine cavity prior to IVF [6]. Although this suggests a causal association of endometrial polyps on fertility, only two studies suggest hysteroscopic polypectomy has a significant impact of on fertility when performed before intrauterine insemination cycles [22, 23]. This contrasts with other studies demonstrating no benefit to hysteroscopic polypectomy [24, 25] including a report that the removal of polyps with a maximum diameter of less than 1.5 cm did not enhance IVF-ET outcomes [25]. Proposed mechanisms related to infertility include an adverse effect on uterine cavity shape, chronic endometritis, and uterine receptivity with altered levels of matrix metalloproteinases and cytokines, such as interferon gamma and glycodelin, pointing to a molecular mechanism that may be related to decreased pregnancy rates among women with EPs [26–28].

When treating patients with simultaneous endometrial polyps and infertility, hysteroscopy has become standard for diagnosis and treatment. Moreover, it is not only necessary to remove polyps, but also to minimize the damage to adjacent endometrium thereby protecting functional endometrium [27]. Multiple surgical options are available including the traditional mechanical resection, mono or bipolar resectoscope [11–13], loop snare [14], and mHTR systems [15–17] in the management of endometrial polypectomy. However, the optimal approach with respect to pregnancy outcomes remains to be clarified.

Goa et al. recently conducted a meta-analysis encompassing eight randomized controlled trials to investigate the clinical implications of five distinct surgical procedures for endometrial polypectomy. Their findings indicate that hysteroscopic electromechanical mHTR exhibited superior clinical outcomes, including the shortest operative time, the highest success rate, and the lowest complication rates, compared to other surgical procedures [29]. With respect to pregnancy outcomes, Bhalani, et al. reported in a retrospective case study that 71% (44/62) of women became pregnant (in which 70% of participants were treated for polyps) with the electromechanical mHTR resection using the MyoSure® device with a 100% complete resection rate and no serious/severe adverse events [30]. Further, the mean treatment-to-pregnancy interval was 8.4 months with an 89% delivery rate associating mHTR resection of intrauterine pathology regarding postoperative pregnancy with favorable outcomes through live birth [29]. A retrospective cohort study by Yong et al. revealed that patients undergoing mHTR (MyoSure) had significantly higher pregnancy rates (65.1% vs. 54.6%, $p = 0.045$) and shorter pregnancy times (13.14 ± 7.85 vs. 16.26 ± 8.22 months, $p = 0.04$) compared to those treated with electroresection for benign intrauterine lesions. No significant differences were observed in full-term live birth, miscarriage, or premature birth rates. The study concluded that mHTR devices not only effectively remove intrauterine lesions but also facilitate endometrial healing, ultimately resulting in a shortened post-operative time to pregnancy [31].

Despite their apparent benefits in surgical efficiency and reproductive outcomes, electromechanical mHTR devices remain costly due to high manufacturing and single-use component expenses. Consequently, some healthcare systems are hesitant to adopt them, even after years of widespread usage. Recently, lower-cost disposable manual mHTR devices, equipped with a handheld trigger, have been innovated to conveniently fit into the 3.0 mm (9 Fr) straight working channel of any hysteroscope, offering a cost-effective alternative. These devices have been clinically approved for use in various applications, encompassing focal lesions such as EPs [32] and retained products of conception. A study investigating the efficacy of manual mHTR systems in hysteroscopic polypectomy [33] revealed that the manual Resectr™ 9Fr (Minerva Surgical) mHTR performed comparably to the electromechanical morcellator (TruClear™) in terms of procedure time, conversion rates, and incomplete resection rates in a head-to-head comparison. Although surgeons favored the electromechanical mHTR system for safety, effectiveness, and comfort ratings. To our knowledge, our current study is the first to report a comparison of the surgical efficacy of manual mHTR versus traditional mechanical resection in hysteroscopic polypectomy on IVF-ET pregnancy outcomes, though surgeons perceived safety, effective and comfort scores favored the electromechanical mHTR systems. Our results suggest that CPRs are similar for either approach. Previous reports also suggest the advantages of the manual mHTR device included the significantly higher complete resection rates with a lower likelihood of requiring additional intervention than traditional mechanical resection. Though some disadvantages of the mHTR device may include surgeon fatigue and device shaking that still need to be considering.

Additionally, research has suggested increased rates of implantation and pregnancy following mild endometrial injury during the menstrual cycle preceding IVF [34, 35]. However, there is limited data on determining the optimal time gap between hysteroscopic polypectomy and ET. One study demonstrated that IVF pregnancy outcomes for women having were similar whether the interval from hysteroscopic polypectomy was < 6 months or ≥6 months [36]. Pereira et al. found that there was no significant difference in the live birth rate of women undergoing IVF-ET at different times after hysteroscopic polypectomy, regardless of whether it was performed after the first, second, third, or more menstrual cycles [37]. Similarly, our results suggest no difference in clinical pregnancy outcomes when comparing the time from surgery and surgical approach.

The present study provides significant strengths, primarily attributed to its notably larger sample size, exceeding those of previous publications, and its comprehensive evaluation of pregnancy outcomes. However, our study is not without limitations including the lack of randomization of surgical treatment type and its retrospective nature which has inherent selection bias. Patient heterogeneity including differences in age and parity for those who underwent traditional resection as well as different ovarian stimulation protocols are also important limitations of this study. Additionally, different patients received different ovarian stimulation protocols, which can also influence the success rate of IVF-ET. To overcome these limitations, future studies should consider performing more rigorous stratification and standardization of patients to reduce the influence of potential confounding factors. Moreover, the issue of small sample sizes in subgroup analysis is also a limitation of this study. Due to the detailed subgroup classification, the number of subjects in each subgroup is relatively small, which may affect the reliability of our results. Other limitations include utilization of a single surgical center, its use only in the operating room setting, and other pathologies thus limiting mHTR's generalizability to different control groups. Further, live-birth rates were not reported and not all frozen embryos were transferred by the time of analysis, potentially impacting CPR. Despite the limitations and selection bias of the study, its results merit further investigation in a prospective setting including a direct comparison with the electromechanical HTR system.

Conclusions

Our results suggest that manual mHTR devices and traditional mechanical resection result in similar clinical pregnancy outcomes. Further, immediate or delayed ET following hysteroscopic polypectomy does not appear to affect pregnancy outcomes. Future cost-benefit studies will help guide balances relating to the place of manual mHTR's in modern practice.

Abbreviations

IVF-ET	In-vitro fertilization and embryo transfer
mHTR	Mechanical hysteroscopic tissue resection device
COS	Controlled ovarian stimulation
PPOS	progestin primed ovarian stimulation
hMG	human menopausal gonadotropins
OR	Oocyte retrieval
HRC	Hormone replacement cycle
PR	Pregnancy rate
CPR	Clinical pregnancy rate
MR	miscarriage rate

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12893-025-02857-1.

Supplementary Material 1

Acknowledgements
We thank all of the patients for their participation in this study.

Author contributions
C.W(First-Author) contributed to Conceptualization, Methodology, Investigation, Writing-Original Draft, Writing-Review & Editing, Visualization; Y.Q.P (First Author) contributed to Methodology, Software, Validation, Formal analysis, Data Curation; Q.M.W, Y.D, H.M.L and Y.S.Y contributed to the surgical procedure, data acquisition, and revision of the manuscript. Y.L contributed to revision of the manuscript. G.L and F.G contributed to revision of the manuscript, Investigation, Resources. JP, NP and I.M contributed to conceptualization, Formal Analysis, Writing-review-editing. S.L contributed to the conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Validation, Writing- original draft. H.C contributed to Conceptualization, Resources, Writing- original draft, Writing - Review & Editing, surgical procedure, data acquisition. All authors read and approved the final version of the manuscript.

Funding
This work was supported by grants from National Key Research and Development Program of China (2022YFC2702500).

Data availability
The data analysed is available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This retrospective cohort study was approved the ethics committee of Reproductive and Genetic Hospital of CITIC-XIANGYA(Number LL-SC-2023-034) and conducted in compliance with privacy act guidelines. All original studies have been approved by the corresponding ethical review board, and the participants provided their informed consent. In addition, no individual-level data were used in this study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 6 May 2024 / Accepted: 17 March 2025
Published online: 02 April 2025

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