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Original article

Tissue removal system versus bipolar resection for hysteroscopic polypectomy: Long-term results

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ABSTRACT

Objective: This study aims to compare long-term outcomes, including recurrence of abnormal uterine bleeding and polyp recurrence, following hysteroscopic polypectomy using either a mechanical tissue removal system or bipolar resection.

Material and methods: This is a multicentre follow-up study of a randomised controlled trial comparing a tissue removal system with bipolar resection for hysteroscopic polypectomy. The study was conducted at Ghent University Hospital (Belgium) and Catharina Hospital Eindhoven (The Netherlands). The trial was approved by the ethical committees of both centres and registered at Clinicaltrials.gov (NCT05337046, April 2022). Thirty-eight patients (49.4%) were willing to participate in this follow-up study, with 19 patients in each group. The primary endpoint was abnormal uterine bleeding recurrence after the procedure. Secondary endpoints included polyp recurrence, symptom relief, patient-reported satisfaction, and need for additional treatments.

Results: Mean follow-up time was over nine years in both groups. The recurrence rate of abnormal uterine bleeding was 25% in the tissue removal system group and 40% in the bipolar resection group ($p = .65$), with a mean time to recurrence of 8.6 years (95% CI, 6.5–10.7 years) in the tissue removal system group and 8.1 years (95% CI, 5.8–10.5 years) in the bipolar resection group ($p = .57$). Furthermore, there was no significant difference in time to polyp recurrence ($p = .93$) or symptom relief between the two groups ($p = .62$).

Conclusion: This long-term follow-up study found no significant difference in the recurrence of abnormal uterine bleeding between a tissue removal system and bipolar resection for hysteroscopic polypectomy.

Introduction

The exact aetiology of endometrial polyps remains unclear. It is likely a multifactorial condition and their heterogeneity makes identification of a single causative factor unlikely [1,2]. The most frequently reported symptom is abnormal uterine bleeding (AUB), which typically presents as heavy menstrual bleeding, intermenstrual bleeding, or postmenopausal bleeding [3,4]. Current evidence supports the removal of symptomatic polyps, while the management of asymptomatic polyps remains debated [5,6].

Hysteroscopic resection of endometrial polyps, allowing for direct visualisation and targeted removal, is now the gold standard. Among the various available techniques, bipolar resection using a resectoscope remains the most widely used. However, since 2005, mechanical tissue removal systems (TRS) or hysteroscopic morcellators have gained increasing popularity.

Meta-analyses comparing bipolar resection with TRS for polyp removal suggest that TRS offers advantages in terms of reduced operating time and more complete tissue removal [7–10]. Additionally, patients undergoing TRS have reported less procedural pain than those undergoing bipolar resection [11]. Complication rates, however, remain contentious, with some studies indicating lower rates for TRS [7,11,12], while others find no significant differences between the two methods [8,8,9,10]. Data on post-operative outcomes, such as AUB persistence or the need for additional treatments, do not suggest significant differences between the techniques [11,13–17].

Recurrence rates for polyps following hysteroscopic polypectomy are approximately 4.9% [18,19], though the recurrence of AUB is higher,

Abbreviations: AUB, Abnormal uterine bleeding; TRS, Tissue removal system; RCT, Randomised controlled trial; CI, Confidence interval.

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ranging between 25% and 60% [20,21]. Risk factors for polyp recurrence include longer follow-up duration, larger polyp size, and the presence of AUB [20,22]. Long-term studies comparing recurrence rates between TRS and bipolar resection are limited. A retrospective study with four years of follow-up found no significant difference in AUB recurrence between the two methods, although there was a non-significant trend towards lower polyp recurrence with TRS (hazard ratio for resection vs TRS of 3.3; 95% CI 0.94–11.49; $p = 0.06$) [23].

This follow-up study aims to compare the long-term clinical outcomes of TRS with bipolar resection for hysteroscopic removal of endometrial polyps, focusing on AUB and polyp recurrence.

Materials and methods

Study design

An observational cohort study was conducted at Ghent University Hospital (Belgium) and Catharina Hospital Eindhoven (the Netherlands) to assess the long-term effectiveness of hysteroscopic polyp removal. Both centres have experience with bipolar resection and mechanical TRS. Data were collected between June 24 and October 13, 2022.

Ethical approval and patient consent

The trial received ethical approval from the committees of both participating centres and was registered with ClinicalTrials.gov (Trial ID: NCT05337046, April 2022). All participants provided written informed consent.

Participants and recruitment

The study population consists of participants from a previous randomised controlled trial comparing a rigid 9.0-mm motor-driven TRS (Truclear^{TM} 8.0, Smith & Nephew, Inc., Andover, MA) with a rigid 8.5-mm bipolar resectoscope (Karl Storz GmbH, Tuttlingen, Germany) for endometrial polyp resection. The original trial was conducted between July 2011 and January 2014 and was published in July 2015 (ClinicalTrials.gov, NCT01537822) [24]. Inclusion criteria for the original trial required patients to have at least one large ($\geq$1 cm) endometrial polyp requiring hysteroscopic resection, typically confirmed by ultrasound and, in most cases, further verified by saline infusion sonography and/or diagnostic hysteroscopy. Exclusion criteria included visual or pathological suspicion of malignancy, untreated cervical stenosis, or any contraindication for operative hysteroscopy. For this follow-up study, patients were additionally excluded if the pathology report from the original intervention did not confirm the presence of an endometrial polyp. All 77 eligible patients from the previous trial were contacted for participation in a structured telephone interview.

Survey content

The survey consisted of a structured telephone interview which was collected and managed using REDCap (Research Electronic Data Capture), a secure web-based platform hosted at Ghent University [25,26].

Participants were asked about their symptoms before and after polypectomy, with a particular focus on AUB and the recurrence or persistence of AUB since treatment. Specific questions addressed whether AUB was present before treatment, resolved postoperatively, and whether it recurred or persisted during the follow-up period. Patients were also asked about any new occurrences of AUB during follow-up, regardless of prior symptoms.

Additional questions assessed the presence of other symptoms typically associated with endometrial polyps, such as abdominal discomfort, as well as the occurrence of new symptoms after polypectomy. Participants were also asked whether they had undergone additional interventions since the initial treatment, including repeat hysteroscopic polypectomy or hysterectomy, and whether polyp recurrence had been confirmed through follow-up imaging or histopathology. Finally, patient-reported satisfaction with both symptom relief and the procedure overall was assessed using a 5-point Likert scale.

The primary outcome of the study was the (time to) recurrence of AUB after initial symptom resolution post-polypectomy. Secondary outcomes included the (time to) persistence or recurrence of AUB, the (time to) any new AUB occurrence during follow-up, confirmed polyp recurrence, need for additional interventions, other symptom recurrence, new symptom development, and patient satisfaction.

Data analysis

Data were analysed using SPSS version 29 (SPSS Inc., Chicago, IL, USA). Normality was assessed with the Shapiro-Wilk test and QQ plots. Non-normally distributed continuous variables were summarised as median (IQR) and compared using the Mann-Whitney *U* test. Normally distributed variables were reported as mean (SD) and analysed with the Student's *t*-test. Categorical data were presented as frequencies (%) and analysed using Chi-square or Fisher's Exact tests, as appropriate.

Survival analysis was used to account for varying follow-up intervals. Kaplan-Meier curves were generated and compared using the Log-rank test, applied to both the primary outcome (time to AUB recurrence) and secondary outcomes (time to recurrence/persistence of AUB, any occurrence of AUB, and polyp recurrence). For patients with persistent AUB, time to recurrence was recorded as zero. Polyp recurrence analysis included only patients with confirmed follow-up imaging; those with unknown status or hysterectomy unrelated to polyp recurrence were excluded. Other secondary outcomes were assessed using Chi-square, Fisher's Exact, or Mann-Whitney *U* tests. Statistical significance was set at $\alpha = .05$.

Results

Thirty-eight of the 77 eligible patients (49.4%) from the original randomised trial agreed to participate in this follow-up study (Fig. 1), with an equal number in the bipolar resection group and the TRS group. Of these, 27 (71%) were treated at Catharina Hospital Eindhoven and 11 (29%) at Ghent University Hospital. Seven out of 84 patients from the original trial were excluded as their original pathology reports could not confirm the presence of an endometrial polyp. Among the 39 patients who did not participate, reasons included being unreachable (12), deceased (3), unwilling to participate (18), or failure to return the informed consent form (6).

Patient characteristics are summarised in Table 1, showing a balanced distribution between the two groups. There were no missing variables in either group. The mean follow-up duration was over nine years for both groups, with 9.72 and 9.38 years recorded for the TRS and bipolar resection groups, respectively ($p = .12$). At follow-up, most patients were postmenopausal (84.2% in both groups; $p = 1.00$).

During follow-up, 12 patients (31.6%) reported AUB. In the TRS group, AUB occurred in seven patients (36.8%), including three with recurrent AUB, two with persistent AUB, and two with new-onset AUB. All patients with recurrent AUB reported a combination of intermenstrual and heavy menstrual bleeding, while persistent AUB cases were limited to heavy menstrual bleeding. One patient with postmenopausal bleeding and a confirmed polyp recurrence underwent repeat hysteroscopic polypectomy. In all other TRS cases, the cause of AUB remained undetermined; two patients underwent endometrial ablation, and three underwent hysterectomy due to persistent symptoms.

In the bipolar resection group, AUB occurred in five patients (26.3%), including four with AUB recurrence and one with new-onset AUB. Among these, three patients presented with postmenopausal bleeding, while the others reported heavy menstrual bleeding or intermenstrual bleeding. Two cases of postmenopausal bleeding had no identifiable cause; one

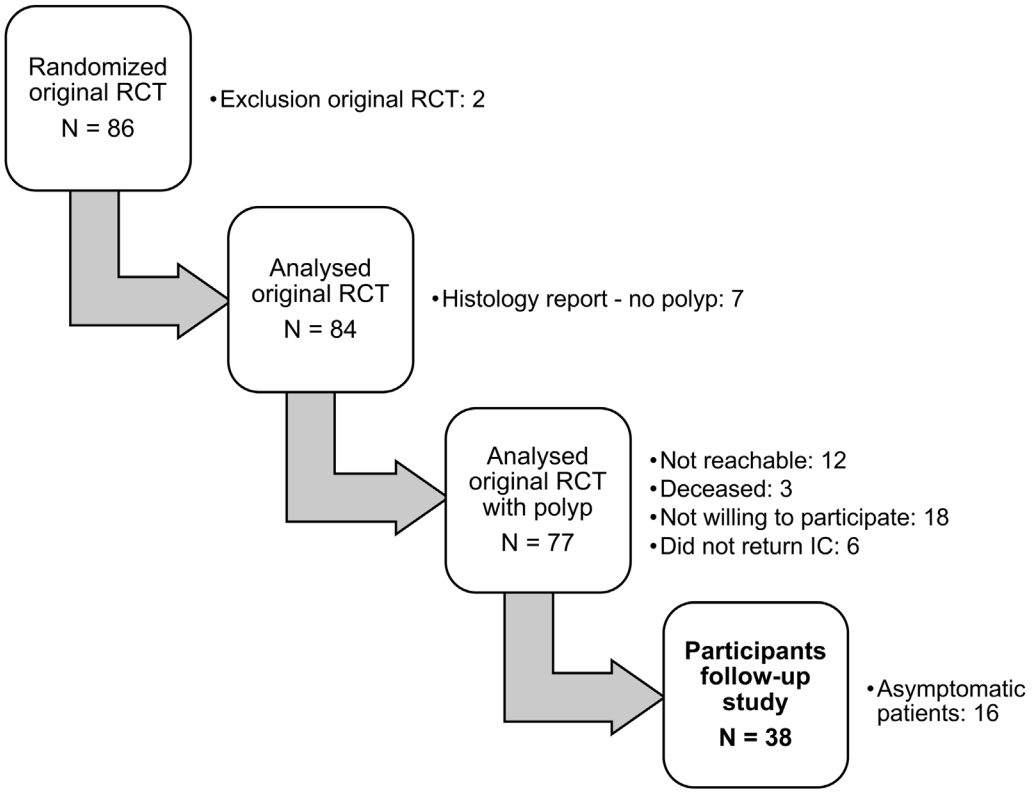

Fig. 1. Patient enrolment.

patient subsequently underwent hysterectomy. Two patients were diagnosed with a recurrent endometrial polyp, confirmed via hysteroscopy, and underwent repeat polypectomy. One case of postmenopausal bleeding was attributed to atrophic vaginal mucosal bleeding.

Data on AUB occurrence post-polypectomy are presented in Table 2. There was no statistically significant difference between the two techniques regarding AUB recurrence, persistence, or new occurrence

Table 1
Patient characteristics per group.

Variable	TRS (n = 19)	Bipolar resection (n = 19)	p-value
Follow-up time (years)	9.72 ± 0.56	9.38 ± 0.74	.12[a]
Age (years)	59.95 ± 9.61	59.37 ± 9.16	.85[a]
BMI (kg/m^2)	24.69 ± 5.57	28.37 ± 10.07	.34[b]
Gravidity	2 ± 1	2 ± 1	.45[b]
Parity	2 ± 1	2 ± 1	.15[b]
Centre			.28[b]
Ghent University Hospital	4 (21.1%)	7 (36.8%)	
Catharina Hospital Eindhoven	15 (78.9%)	12 (63.2%)	
Postmenopausal status* at intervention	8 (42.1%)	9 (47.4%)	.74[c]
Postmenopausal status* at follow-up	16 (84.2%)	16 (84.2%)	1.00[d]
Subfertility as indication for treatment	2 (10.6%)	2 (10.6%)	1.00[d]
Smoker	6 (31.6%)	10 (52.6%)	.19[c]
Type 2 diabetes mellitus	2 (10.6%)	1 (5.3%)	1.00[d]
Cancer history	3 (15.8%)	4 (21.0%)	1.00[d]
Cardiovascular disease history	5 (26.3%)	5 (26.3%)	1.00[c]
ASA score			.69[d]
ASA I	6 (31.6%)	9 (47.4%)	
ASA II	10 (52.6%)	7 (36.8%)	
ASA III	3 (15.8%)	3 (15.8%)	
ASA IV	0 (0.0%)	0 (0.0%)	

BMI = body mass index; ASA = American Society of Anesthesiologists. Data are mean ± SD for normal distribution, median ± IQR for skewed distribution or number (% within group) for categorical.

[a] p-value from unpaired Student's t-test.
[b] p-value from Mann-Whitney U test.
[c] p-value from Chi Square test.
[d] p-value from Fisher's Exact test.
* >1y no menstruation.

Table 2
Characteristics of AUB and need for additional treatment due AUB symptoms.

Variable	TRS (n = 19)	Bipolar resection (n = 19)	p-value
AUB before polypectomy	12 (63.2%)	10 (52.6%)	.51[a]
Any AUB after polypectomy	7 (36.8%)	5 (26.3%)	.49[a]
AUB recurrence	3 (15.8%)	4 (21.1%)	
AUB persistence	2 (10.5%)	0 (0.0%)	
New AUB occurrence	2 (10.5%)	1 (5.3%)	
Need for additional treatment due to AUB symptoms after initial treatment	6 (31.6%)	3 (15.8%)	.52[b]
Hysteroscopic polyp removal	1 (5.3%)	2 (10.5%)	
Second generation endometrial ablation	2 (10.5%)	0 (0.0%)	
Hysterectomy	3 (15.8%)	1 (5.3%)	

TRS = tissue removal system; AUB = abnormal uterine bleeding. Data are number (% within group).
[a] p-value from Chi Square test.
[b] p-value from Fisher's Exact test.

(p = .49). No statistically significant difference was found between the groups in terms of requiring additional treatment for AUB (p = .52).

In the TRS group, for patients with AUB before polypectomy, the mean time to AUB recurrence was 8.6 years (95% CI, 6.5–10.7 years; n = 12). In the bipolar resection group, the mean time to AUB recurrence was 8.1 years (95% CI, 5.8–10.5 years; n = 10). The log-rank test showed no statistically significant difference between the two groups (p = .57). The time-to-recurrence curve is shown in Fig. 2.

The log-rank test also showed no statistically significant difference between the groups for AUB recurrence and/or persistence (p = .81) or for any AUB occurrence (p = .51).

Of the 34 patients with confirmed presence or absence of endometrial polyps during follow-up, nine had confirmed polyp recurrence (26.5%). Recurrence was diagnosed via diagnostic hysteroscopy in four patients, conventional transvaginal ultrasound in one patient, and a combination of saline infusion sonography and diagnostic hysteroscopy in one patient. All six of these patients subsequently underwent hysteroscopic polypectomy, with histopathological confirmation of an endometrial polyp. In the remaining three cases, hysterectomy was performed without prior imaging. Indications for hysterectomy included persistent abdominal discomfort in one patient, persistent heavy menstrual bleeding in another, and combined recurrent intermenstrual and heavy bleeding in the third. In these cases, polyp recurrence was confirmed histopathologically following hysterectomy. In the other 25 patients (73.5%), polyp recurrence was excluded by conventional ultrasound, saline infusion sonography, or diagnostic hysteroscopy.

The mean time to polyp recurrence was 8.1 years (95% CI, 5.6–10.5 years; n = 17) in the TRS group and 7.7 years (95% CI, 5.5–9.9 years; n = 17) in the bipolar resection group. The log-rank test showed no statistically significant difference in polyp recurrence rates between the two groups (p = .93). The time-to-recurrence curves are shown in Fig. 3, both showing a decline towards the end, reflecting polyp recurrence in the patient with the longest follow-up in each group.

Symptom relief and satisfaction scores are shown in Table 3. In the TRS group, 63.2% (n = 12) presented with symptoms before treatment, of which eight (66.7%) reported complete relief, while two (16.7%) reported partial relief and in two (16.7%) others, no change in symptoms was observed. In the bipolar resection group, 57.9% (n = 11) of patients had symptoms before treatment, and 10 (90.9%) reported complete symptom relief. Satisfaction with symptom relief was high overall, yet significantly higher in the bipolar resection group (p = .03), although overall satisfaction did not differ between the groups (p = .60).

Discussion

This study is a follow-up of a randomised controlled trial comparing the effectiveness of hysteroscopic mechanical TRS and bipolar resection for removing endometrial polyps. Our findings show no statistically significant differences between the two techniques regarding AUB recurrence following hysteroscopic polypectomy.

We observed an AUB recurrence rate of 25% in the TRS group and 40% in the bipolar resection group (p = .65), with a mean time to AUB

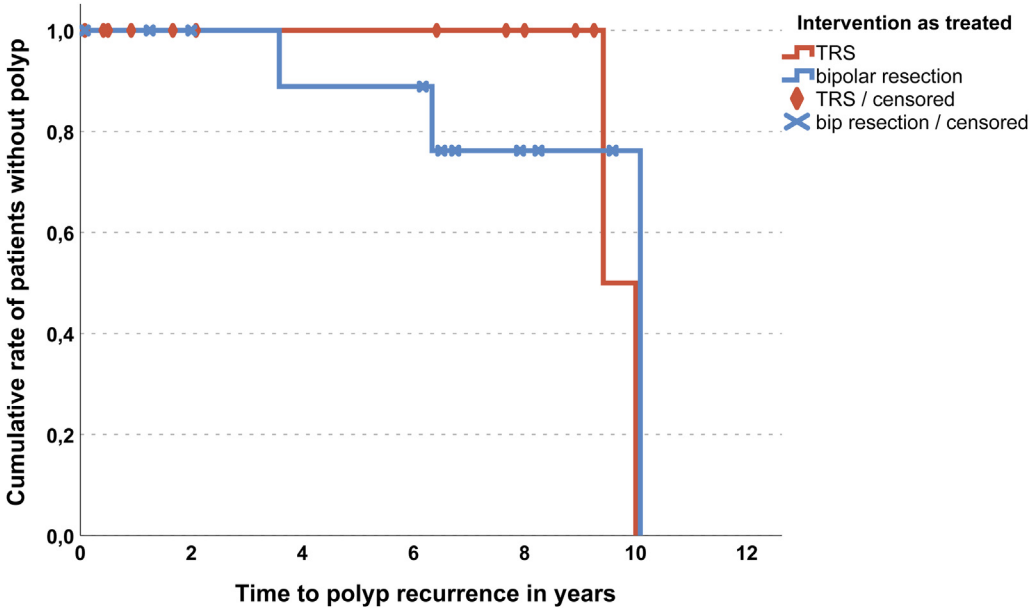

Fig. 3. Time to polyp recurrence in the TRS and bipolar resection groups.

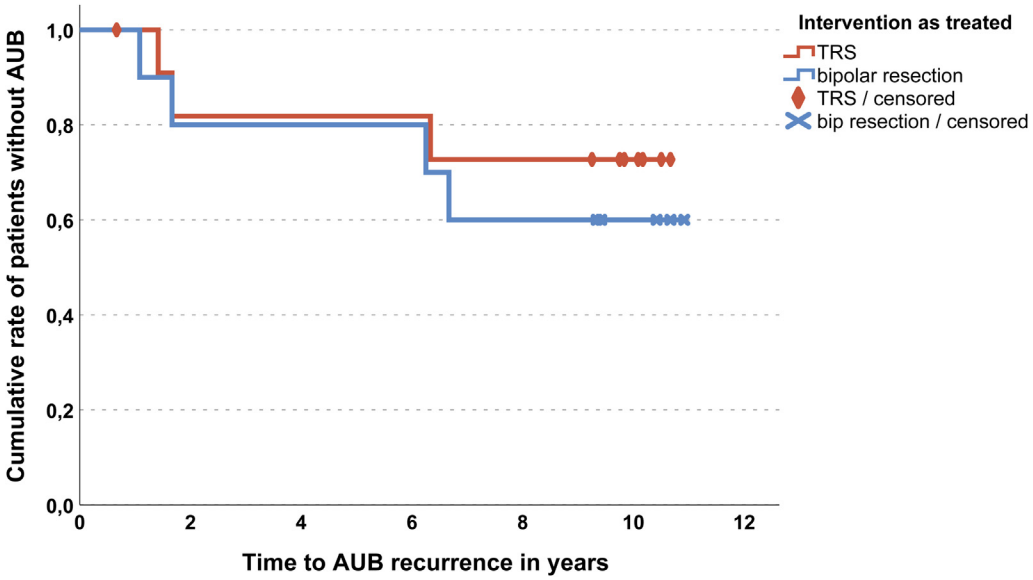

Fig. 2. Time to AUB recurrence in the TRS and bipolar resection groups.

Table 3
Symptom relief and satisfaction scores.

Variable	TRS	Bipolar resection	p-value
Symptom relief after treatment	(*n* = 12)*	(*n* = 11)*	.62[a]
No difference	*2 (16.7%)*	*0 (0.0%)*	
Partial relief	*2 (16.7%)*	*1 (9.1%)*	
Complete relief	*8 (66.7%)*	*10 (90.9%)*	
Satisfaction score (symptom relief)**	4 [3.25–4] (*n* = 12)*	5 [5–5] (*n* = 11)*	**.03**[b]
Satisfaction score (general)**	5 [4–5] (*n* = 19)	5 [4–5] (*n* = 19)	.60[b]

TRS = tissue removal system. Data are number (% within group) for categorical or median for continuous variables.
Bold means p < 0.05 and thus statistical significance.
[a] p-value from Fisher's Exact test.
[b] p-value from Mann-Whitney *U* test.
* Only patients who were symptomatic before polypectomy were included for this outcome.
** 5-point Likert scale.

recurrence of 8.6 and 8.1 years (p = .57), respectively. There is limited literature comparing the long-term outcomes of both techniques. Maheux-Lacroix et al. reported similar AUB recurrence rates of 38% after TRS, with a mean follow-up of 29 ± 13 months [28]. AlHilli et al. found lower recurrence rates of 15.1% after TRS and 20.9% after resection using microscissors or graspers. These lower rates could be attributed mainly to the shorter follow-up period of four years [23].

A previous study by our group, comparing long-term outcomes between manually driven TRS and motor-driven TRS, found an AUB recurrence rate of 17.0%, with a mean time to recurrence of 2.2 years (95% CI 1.7–2.7) in the manually driven group and 2.4 years (95% CI 1.9–2.8; p = .77) in the motor-driven group. The lower recurrence rates and shorter time to recurrence may be due to the shorter follow-up period in this study (mean: 1.9 years). As with our present findings, there was no significant difference in polyp recurrence (p = .22) or symptom relief (p = .67), and patient satisfaction scores were similarly high [29].

In terms of polyp recurrence, this study found a rate of 26.5%, which is higher than reported in other studies. For example, AlHilli et al. observed recurrence rates of 4.5% and 10.6% at two and four years after treatment [23], while Ceci et al. reported rates of 10.4% for bipolar resection and 7.1% for TRS after a one-year follow-up [30]. However, García et al. reported a notably higher polyp recurrence rate of 21.4% after bipolar resection, but did not study patients undergoing TRS [20]. The longer follow-up period in our study likely accounts for the higher recurrence rates observed.

Symptom relief was achieved in 100% of patients in the bipolar resection group and 83.3% in the TRS group (p = .62), which aligns with previous findings. Nathani et al.'s systematic review reported symptom improvement rates between 75% and 100% after polypectomy [22]. Another study involving 118 patients also demonstrated significant symptom relief and improved quality of life following hysteroscopic TRS of polyps or uterine fibroids, though the study did not differentiate between polyps and myomas and lacked a control group [31].

Patient satisfaction was generally high for both procedures, with overall median satisfaction ratings of 5/5 in both groups. However, median satisfaction with symptom relief was slightly higher for bipolar resection (4/5 vs 5/5; p = .03). These results are in line with previous research, where patients consistently report high satisfaction after hysteroscopic polypectomy, regardless of the technique used. For instance, in a study of 848 patients undergoing outpatient hysteroscopic polypectomy, 87.1% reported satisfaction scores between 8 and 10 on a 10-point Likert scale [32]. Similarly, studies focusing on mechanical TRS have also reported high levels of satisfaction [27,28].

Of patients with AUB after polypectomy, 75% (n = 9; 23.7% overall) required additional treatment, of which four underwent a hysterectomy. This is in line with the findings of AlHilli et al., who reported that 70.1% of patients with AUB after polypectomy (12.9% overall) underwent further treatment, with 19.3% (3.5% overall) eventually requiring hysterectomy. However, no distinction was made between TRS and bipolar resection in this analysis [23].

A key strength of this study is the long follow-up period, as it allows for a thorough evaluation of long-term outcomes. Additionally, the randomised nature of the original trial minimises selection bias, and the multicentre setup and inclusion of both pre- and postmenopausal

patients enhances the generalisability of the findings. Moreover, all patients from the original RCT were contacted for inclusion and follow-up, including those who sought care at other centres or did not seek medical attention for their symptoms. However, this follow-up study was inherently limited by the sample size of the original trial, as no new participants could be recruited beyond those initially randomised. Additionally, the extended time between the original intervention and this follow-up study resulted in a considerable proportion of patients being unreachable, deceased, or declining participation, further reducing the sample size. Consequently, no formal sample size calculation was performed, as the study population was constrained by the number of available participants. The relatively small sample size limited the statistical power to detect significant differences between groups for most outcomes and may have introduced nonresponse bias. Finally, data collection via telephone interviews introduced the risk of both interviewer and recall bias, particularly given the long follow-up interval.

In conclusion, this study adds to the growing evidence that both mechanical TRS and bipolar resection are effective for removing endometrial polyps, with no significant differences in terms of AUB recurrence, polyp recurrence, or patient satisfaction overall. However, larger studies with standardised follow-up protocols are needed to confirm these results and clarify the long-term outcomes associated with each procedure. Asymptomatic endometrial polyps present a lower malignancy risk (1.9%) compared to symptomatic ones (5.1%; $p < .001$), yet their management remains debated, warranting further research in this area [5,6]. Future research should also explore the cost-effectiveness of various hysteroscopic techniques, and examine patient characteristics, such as hormonal status and comorbidities, to better predict recurrence and symptom persistence after polypectomy.

CRediT authorship contribution statement

Basiel Weyers: Writing – original draft, Visualisation, Validation, Software, Project administration, Methodology, Formal analysis, Data curation, Conceptualisation. Margot Van Geyte: Writing – review & editing, Validation, Methodology, Formal analysis, Conceptualisation. Alejandra de Frenne: Writing – review & editing, Validation, Methodology, Formal analysis, Conceptualisation. Steven Weyers: Writing – review & editing, Validation, Supervision, Methodology, Investigation, Conceptualisation. Huib van Vliet: Writing – review & editing, Validation, Supervision, Methodology, Investigation, Conceptualisation. Steffi van Wessel: Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualisation. Tjalina Hamerlynck: Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualisation.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to improve readability and language. After using this service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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