World Journal of Surgical Oncology

RESEARCH

Open Access

Clinical efficacy study of the IBS® (Intergrated Bigatti Shaver) Tissue Removal Device in the treatment of endometrial polyps

Yifei Wang[1†], Xiurong Cao[1†], Xiang Fan[1] and Pengfeng Zhu[1*]

Abstract

Background The IBS® Tissue Removal Device, as a new technology, currently lacks a systematic evaluation of its effectiveness in treating endometrial polyps. Furthermore, the exact cause of polyps recurrence is not yet clear. The purpose of this article is to compare the efficacy of the IBS® Tissue Removal Device with hysteroscopic cold knife resection for the treatment of endometrial polyps and analyze the recurrence factors of endometrial polyps.

Methods 202 patients with endometrial polyps who were admitted to Changzhou Maternal and Child Health Care Hospital from January 2019 to December 2022 were included in the retrospective studies. Based on the surgical technique, these patients were categorized into two groups: the IBS group ($n=100$) and the cold knife group ($n=102$). Following surgery, both groups underwent a year of follow-up. Data from the perioperative period (operation time, intraoperative blood loss, intraoperative rehydration, intraoperative complications, length of hospital stay), follow-up data (postoperative endometrial thickness, postoperative vaginal bleeding time, complication rate, menstrual recovery time, pregnancy rate, and recurrence rate) and general clinical data (age, BMI(Body mass index, BMI), number of pregnancies or miscarriages, number of hysteroscopic operations, preoperative white blood cells, fasting blood glucose, polyp diameter) were compared between the two groups.

Results The recurrence rate of the IBS group was 6% (6/100), which was lower than that of the cold knife group (14.7% (15/102), and the difference was statistically significant ($P<0.05$). The operation time, intraoperative blood loss, and postoperative vaginal bleeding time in the IBS group were significantly lower than those in the cold knife group ($P<0.05$), and the multivariate analysis of polyp recurrence showed that polyp diameter was closely related to postoperative recurrence ($P<0.05$). The preoperative white blood cells and blood sugar levels have no association with the diameter of polyps. ($P>0.05$). There was also no significant difference between IBS group and cold knife group in intraoperative rehydration, intraoperative complications and postoperative hospital stay, intermenstrual bleeding, recovery of menstruation and endometrial thickness and postoperative pregnancy between the IBS group and the cold knife group ($P>0.05$).

†Yifei Wang and Xiurong Cao are co-frst author and contributed equally to this work.

*Correspondence:
Pengfeng Zhu
zpf68999@163.com

Full list of author information is available at the end of the article

Conclusion The IBS® Tissue Removal Device can reduce the recurrence rate of endometrial polyps after surgery, improve the perioperative indexes, and reduce the postoperative vaginal bleeding time, which is better than that of hysteroscopic cold knife resection.

Keywords Endometrial polyps, Intergrated Bigatti Shaver(IBS®), Hysteroscopic cold knife resection, Endometrium, Recurrence rate, Haemorrhage

Introduction

Endometrial polyps are mostly localized endometrial hyperplasia [1]. Most patients are asymptomatic, and those who do present with abnormal uterine bleeding and, in some cases, dysmenorrhea and infertility. Most EP(endometrial polyp, EP) are benign, but malignant transformation is possible [2]. Endometrial polyps are highly susceptible to recurred [3]. Reports suggested that age, BMI, the number of polyps, and a history of previous surgeries may all be associated with polyp recurrence [4–6]. Previous literature has shown that inflammatory factors and hyperglycemic environment have an effect on polyp formation [7, 8]. During an active inflammatory process in the body, leukocytes (CD45), macrophages (CD68), plasmacells (CD138) and NK (CD56) cells, whose activity and focal infiltrates leads to excess abnormal proliferation of endometrium. Furthermore, the hyperglycemic environment in the body will abnormally increase many growth factors, especially IGF-1(insulin-like growth factor I, IGF-1), in serum and endometrial tissue, resulting in pathological conditions of the endometrial [9, 10]. All of these eventually lead to the occurrence of endometrial polyps. Surgery is now recommended for symptomatic patients, and hysteroscopy has become the gold standard technique for endometrial polyps [11, 12], mainly including cold knife mechanical excision, conventional bipolar and monopolar resectoscopy, and IBS® Tissue Removal Device. The conventional resectoscope, despite its versatility [13], has high risk of overload syndrome with water intoxication [14–16], additionally, uncontrolled leakage of high-frequency electric current during resection, which will cause uterine perforation with bowel injury and internal and external burns [17]. Hysteroscopic cold knife resection refers to under hysteroscopy, mechanical sharp resection of the uterine cavity occupying lesion is performed using various micro surgical instrument such as scissors, grasping forceps, and spoon forceps, and the specimens are retrieved using biopsy forceps. While avoiding electrical damage and high fluid load, is associated with high rates of residual tissue and relapse, particularly in cases of multiple polyps [18]. The IBS® Tissue Removal Device, representing a novel cold knife system that offers precise intraoperative positioning, clear visualization, no electrical damage to the endometrium, and controllable fluid load, uses a blunt planing head to rotate rapidly in the cutting window to cut the uterine cavity mass, and the resected tissue is immediately suctioned and collected in a tissue trap under continuous negative pressure [19].

At present, reports about mechanical hysteroscopic tissue removal systems (cold knife resection or IBS®) versus conventional bipolar and monopolar resectoscopy for the treatment of polyp can be easy access to, however, there is little published data about the efficacy of hysteroscopic cold knife and the IBS® Tissue Removal Device in the treatment of endometrial polyp. As a new type of cold knife mechanical excision technology, besides having the advantages of cold knife: the surrounding healthy endometrium is respected without any thermal injury and its operation time and total removal rate are more better than conventional resectoscopy [20], the IBS® Tissue Removal Device gives surgeon a better visualization and controllable shaving depth during the procedure as tissue chips are removed at the same time of resection, avoiding repeatedly entering and exiting the uterine cavity, no coagulation is needed, and we have no extra bleeding problems [19]. Individual studies lack sufficient data to provide a precise evaluation about pregnancy and recurrence rate after surgery. In addition, safety and efficacy of the IBS® Tissue Removal Device have not been systematically evaluated. Therefore, we boldly speculate that compared with cold knife resection, the IBS® Tissue Removal Device may have shorter operation time, less intraoperative blood loss, and can significantly reduce postoperative complications, protect endometrium, reduce recurrence and improve pregnancy, which means the safety and long-term efficacy of the IBS® Tissue Removal Device may be superior to those of cold knife. The aim of the study was to verify our conjecture and fill in the data gaps of previous studies. The main outcome measures are pregnancy and recurrence within 1 year after surgery. The secondary outcome measures are operation time, intraoperative blood loss, intraoperative rehydration, intraoperative complications, length of hospital stay, postoperative endometrial thickness, postoperative vaginal bleeding time, complication rate, menstrual recovery time. Considering that polyps are prone to recurrence and are affected by inflammation and hyperglycemia, the analysis of the final results in this study also included these two aspects.

Materials and methods

Study design

202 patients with endometrial polyp admitted to Changzhou Maternal and Child Health Care hospital from January 2019 to December 2022 were analyzed retrospectively. According to different surgical methods, it was divided into experimental group and control group, the experimental group used the IBS® Tissue Removal Device (referred to as the IBS group), and the control group used the hysteroscopic cold knife resection system (referred to as the cold knife group). The 202 patients included 100 in the IBS group and 102 in the cold knife group. The clinical data of 202 patients were collected, including detailed medical history data, surgical data (operation time, intraoperative blood loss, intraoperative rehydration, intraoperative complications, polyp diameter and hospital stay) and postoperative follow-up data, and the follow-up data mainly included pregnancy rate and recurrence rate, complication rate, menstrual recovery time, postoperative endometrial thickness, and postoperative vaginal bleeding time. Preoperative leukocyte and blood glucose levels were analyzed to see if there was any effect on polyp size. We also established a multifactor analysis model of the above data with polyp recurrence in order to find the relationship between them. The study was approved by the Ethics Committee and Institutional Review board of Changzhou Maternal and Child Health Care Hospital (Changzhou, China; approved on 25/11/2021, ref: 202169).

Study population

Inclusion criteria: (1) The medical history data are detailed and complete, and there are no missing medical records; (2) Have a childbearing requirement and be between the ages of 20–45; (3) Surgical pathology confirmed endometrial polyps, and the diagnostic criteria refer to "Gynecological Pathology"; (4) Have not received hormonal intervention in the past 3 months; (5) Regular postoperative reexamination and follow-up, and the follow-up data are complete. Exclusion criteria: (1) Combined with malignant lesions; (2) Contraindications to surgery: acute reproductive system and pelvic infection: severe medical and surgical diseases and other patients who cannot tolerate surgery; (3) Combined with uterine fibroids, adenomyosis, endometriosis, functional uterine bleeding and other related diseases; (4) Lack of medical history and follow-up data; (5) Patients or their family members do not cooperate with diagnosis and treatment and follow-up.

Study treatment

Preoperative preparation

All patients were given a thorough medical history upon admission and underwent comprehensive blood tests, liver and kidney function tests, urinalysis, thyroid function tests, coagulation tests, biochemical tests, HCG (Human chorionic gonadotophin, HCG) tests, vaginal discharge tests, HPV (Human papilloma virus, HPV) tests, TCT (Thinprep cytologic test, TCT), and ECG (Electrocardiogram, ECG) tests. All patients underwent a gynecological examination. After ruling out serious medical and surgical diseases and acute genital tract infections, meanwhile there are no relevant contraindications, surgical treatment is carried out after signing the informed consent form for surgery.

Surgical procedure

All patients in both groups were operated on 3–7 days after the end of their menstrual period, and they were all asked to fasting and not to drink any liquids for 8 h before the operation. The patient emptied the bladder before the operation, took the bladder lithotomy position. Routinely disinfected the vulva and vagina, used intravenous anesthesia and the operation timing began. The IBS group was treated with the IBS® Tissue Removal Device (Karl Storz GmbH & Co.KG, Tuttlingen, Germany). 0.9% normal saline was used as the uterine distension medium (Huaren Pharmaceutical Co., Ltd., Guoyao Zhunzi H20034093, drug specification: 3000 ml: 27 g). The intrauterine pressure was set to 100 ~ 130 mmHg(1 mmHg = 0.133 kPa), and the flow rate of suction pump was 350 mL/min. After dilating the internal ostium of the uterine cervix up to Hegar number 8 mm, setting the maximum flow to 450 ml/min, the hysteroscope was inserted into the uterine cavity. Then, we observed the shape of the uterine cavity, bilateral fallopian tube openings, and the size, location, and number of lesions, placing the planing system operator into the uterine cavity. The outer sheath diameter was of 24 Fr (8 mm). We used the Model: 26208SA shaver tip and set the rotational speed to 2200 ~ 2 500 r·min. The tip was pressed against the intrauterine lesion and performed reciprocating rotational shaving. Meanwhile, the rotated-out residues were aspirated until no residue remained (Fig. 1). Gauze was used to wrap the outlet of the suction tube for collecting specimens for examination. The cold knife group was treated with hysteroscopy operating system (Karl Storz GmbH & Co.KG, Tuttlingen, Germany). The dilatation solution, dilatation pressure, and flow rate were set the same as in the IBS group. A hysteroscope was inserted to examine the location, size, and number of the lesions. The outer sheath diameter was of 16.5 Fr (5 mm). The surgical scissors and grasping forceps were used to completely remove the polyp from the pedicle of it (Fig. 2). The biopsy forceps were then used to take out the lesions. In the Cold Knife Group, for multiple small polyps in the uterine cavity, we also used sharp curettage to clean the entire uterine cavity. All tissues removed were sent

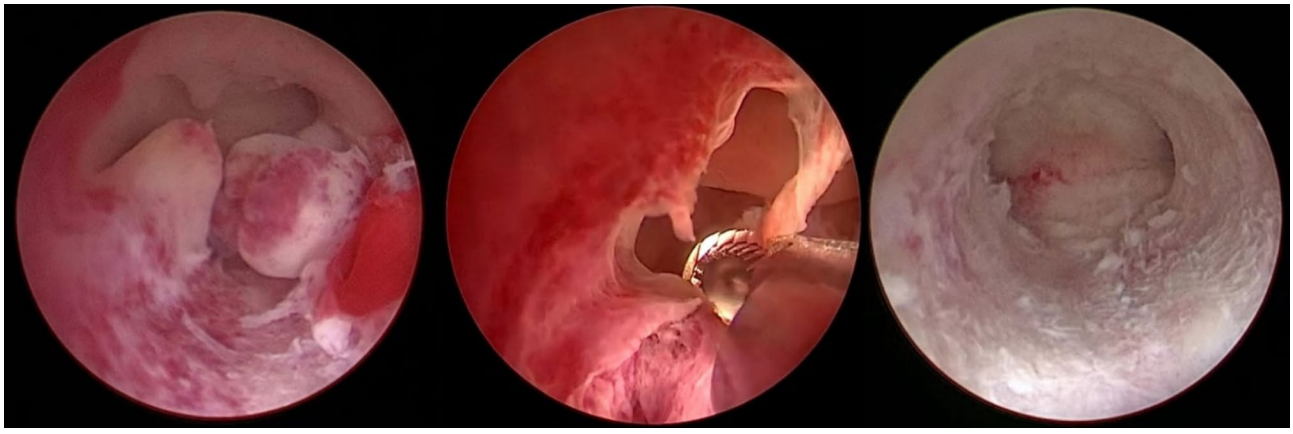

Fig. 1 IBS® before and after polypectomy

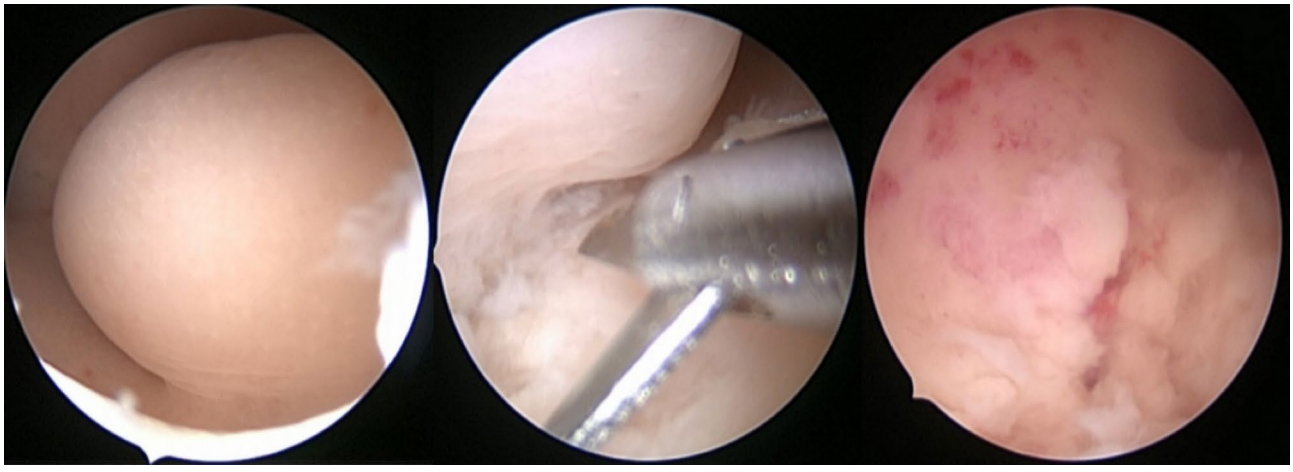

Fig. 2 Cold knife before and after polypectomy

for pathological examination. In both two groups, when the lesion was completely removed, the uterine cavity morphology, wound bleeding, and bilateral fallopian tube openings were observed again, and 5 ml of sodium hyaluronate was placed to prevent the occurrence of IUA (intrauterine adhesions, IUA), finally the operation was terminated. A standard gynaecological set-up was used in the operating room. Patients in both groups received routine anti-infection treatment after operation.

Postoperative treatment regimen

ECG monitoring was routinely given after surgery, and the patient's vital signs and vaginal bleeding were closely monitored. Unless there are specific complications, the patient is to be discharged from the hospital on the day following surgery, with follow-up and medication instructions provided after receipt of the pathology report.

Study outcomes

The patients were followed up by telephone and outpatient examinations for 1 year, including postoperative endometrium, menstruation, pregnancy and recurrence. Diagnostic criteria for recurrence: ultrasound suggests uterine cavity mass and the diagnosis is confirmed by hysteroscopy. Postoperative pregnancy criteria: blood HCG shows positive, and gynecological color ultrasound shows intrauterine pregnancy.

Statistical analysis

SPSS25.0 statistical software was used to process the data in this study. For the continuous data, the Shapiro-Wilk-test was used for normality test, and the data conforming to the normal distribution were expressed as mean ± standard deviation ($\bar{x} \pm s$), and the t-test was used for comparison between the two groups. Non-normally distributed data were expressed as median + quartile [M(Q25,Q75)], and the rank-sum test was used for comparison between the two groups. The use of counts or the composition ratio was expressed using the χ^2 test and the Fisher exact

Table 1 IBS vs. Cold knife group in general data

Variable	IBS	Cold knife	t/Z value	*p* value
Cases, N	100	102		
Age(years)	39.61 ± 10.283	37.30 ± 9.136	1.686	0.093[a]
BMI	22.663 ± 3.3924	22.320 ± 3.3004	0.729	0.467[a]
Pregnancy	2(1,2)	2(1,3)	-0.242	0.809[b]
Miscarriage	0.5(0,1)	0(0,1)	-0.430	0.667[b]
Previous intrauterine operation	1(0,2)	1(0,2)	-0.316	0.752[b]
Polyp size(cm)	1(1,1.5)	1(0.8,1)	-1.862	0.063[b]

IBS Intergrated Bigatti Shaver, *BMI* Body Mass Index, *cm* Centimeters, *a* t-test, *b* rank-sum test

Table 2 Relationship between preoperative white blood cells and fasting blood glucose and polyp diameter

	Polyp diameter ≤ 1 cm	Polyp diameter > 1 cm	t value	*p* value
preoperative white blood cells(*10^9/L)	6.0754 ± 2.13441	5.8758 ± 1.89144	0.617	0.538
preoperative fasting blood glucose(mmol/L)	4.8587 ± 0.42615	4.9477 ± 0.51113	-1.261	0.209

Table 3 Comparison of perioperative data between IBS group and Cold knife group

	IBS	Cold knife	t/Z value	*p* value
Operation time(min)	13.40 ± 5.453	16.75 ± 6.180	-4.088	< 0.01[a]
Intraoperative rehydration(ml)	500(500,500)	500(500,500)	-0.786	0.432[b]
Intraoperative blood loss(ml)	5(5,5)	5(5,5)	-2.745	0.006[b]
Length of hospital stay(d)	1(1,1)	1(1,1)	-1.391	0.164[b]

min Minutes, *ml* Milliliters, *d* Days, *a* t-test, *b* rank-sum test

probability method to compare the differences between groups. $P<0.05$ was statistically significant.

Results

A total of 202 patients with endometrial polyp were included in this study, 100 were in IBS group and 102 in Cold Knife group. There was no significant difference between IBS group and Cold Knife group in age, BMI, times of pregnancy and delivery, times of uterine cavity operation and polyp diameter. ($p>0.05$) (Table 1). Moreover, the results in our study showed that there was no significant difference between the white blood cells, blood glucose and polyp diameter before operation. ($p>0.05$) (Table 2).

All 202 patients successfully underwent the procedure and achieved complete clearance of the lesions in a single session. There were two intraoperative complications (1 case of postoperative hemorrhage and 1 case of postoperative infection) in cold knife group. The mean operation time in IBS group (13.40±5.453 min) was significantly shorter than that in cold knife group (16.75±6.180 min) ($p<0.05$). The blood loss in IBS group was less than that in cold knife group ($p<0.05$). There was no significant difference between IBS group and cold knife group in intraoperative rehydration, intraoperative complications and postoperative hospital stay ($p>0.05$) (Table 3). It was found that the mean postoperative vaginal bleeding time in IBS group (4.77±0.993 d) was significantly shorter than that in cold knife group (5.09±1.252 d)($p<0.05$). There was also no significant difference between the two groups in intermenstrual bleeding, recovery of menstruation and endometrial thickness ($p>0.05$) (Table 4).

Table 4 Comparison of menstrual and endometrial conditions between IBS group and Cold knife group

	IBS	Cold knife	χ^2/t value	*p* value
Intermenstrual bleeding				
Yes	2(28.57)	5(71.43)	1.211	0.271[c]
No	98(50.26)	97(49.74)		
postoperative vaginal bleeding time(d)	4.77 ± 0.993	5.09 ± 1.252	-2.004	0.047[a]
menstrual recovery time(d)	29.49 ± 4.770	30.69 ± 4.318	-1.799	0.074[a]
postoperative endometrial thickness(mm)	8.012 ± 2.8310	7.505 ± 3.0689	1.220	0.224[a]

mm Millimeters, *a* t-test, *c* χ^2 test

Table 5 Comparison of pregnancy and recurrence between IBS group and Cold knife group

	IBS	Cold knife	χ^2 value	*p* value
Pregnancy status(have pregnancy intention)				
be pregnant	21(48.84)	22(51.16)	2.137	0.144
not pregnant	2(22.22)	7(77.78)		
Recurrence				
yes	6(28.57)	15(71.43)	4.108	0.043
no	94(51.93)	87(48.07)		

The recurrence rate of IBS group was 6% (6/100), which was significantly lower than that of cold knife group (14.7%, 15/102)($p<0.05$). There was no significant difference in postoperative pregnancy between the IBS group and the cold knife group ($P>0.05$) (Table 5). Through follow-up, we found that the recurrence of the population after different surgical methods. The logistic regression analysis model showed that polyp diameter was related to the recurrence and the difference was statistically significant ($P<0.05$) (Table 6).

Table 6 Multiple factors analysis of endometrial polyp recurrence

Variables	OR value	95%CI	*p* value
Age(years)	0.693	(0.242, 1.978)	0.493
Pregnancy	2.674	(0.617,11.593)	0.189
Fertility	0.717	(0.212,2.423)	0.592
intrauterine operation	0.251	(0.057, ,1.109)	0.068
BMI	0.41	(0.138,1.216)	0.108
Polyp diameter(cm)	0.236	(0.061,0.910)	0.036
Operation time(min)	0.939	(0.270,3.269)	0.921
Intraoperative rehydration(ml)	13.831	(0.807,237.035)	0.07
Intraoperative blood loss(ml)	0.229	(0.021,2.466)	0.224
Length of hospital stay(d)	1.071	(0.288,3.977)	0.918
preoperative white blood cells(*10^9/L)	0.38	(0.136,1.062)	0.065
preoperative fasting blood glucose(mmol/L)	1.524	(0.606,3.834)	0.371
postoperative vaginal bleeding time(d)	1.893	(0.715,5.011)	0.199
Intermenstrual bleeding	2.983	(0.441,20.162)	0.262
menstrual recovery time(d)	0.554	(0.047,6.480)	0.638

cm Centimeters, *min* Minutes, *ml* Milliliters, *d* Days

Discussion

Prior research has indicated that localized infiltration of inflammatory cells within the endometrium can lead to polyp development as a result of excessive and aberrant endometrial proliferation driven by local inflammatory activity, even in cases without hormone receptor disorders [7]. A retrospective examination of clinical data involving 353 patients in Italy revealed a statistically significant link between age, menopause status, hypertension, obesity, and EP occurrence [3]. Consequently, this study also explored associations between preoperative white blood cell counts, blood glucose levels, and polyp diameter. However, due possibly to limited sample and predominantly normal levels observed among participants, no correlation was established. Future studies will require an expanded sample size for further exploration.

The average operation time of the IBS group (13.40±5.453 min) was significantly shorter than that of the cold knife group (16.75±6.180 min). The median intraoperative blood loss in the IBS group was smaller than that in the cold knife group. Ascribe to the shaving system can resect and suction at the same time, which avoids blood clots and resected tissue blocking the surgical field of view, and is convenient for the surgeon to operate accurately, thereby shortening the operation time and reducing intimal damage and intraoperative bleeding [21]. Our study was aligning with previous literature conclusions.There was no significant difference in intraoperative fluid rehydration between the two, which may be related to the fact that the hysteroscopic operation time is generally short and the difference in fluid rehydration volume cannot be significantly reflected [22]. Although uterine endometrial polyps have an extremely low risk of malignancy, the potential for malignancy rises as one grows older [23]. The superiority of the cold knife procedure was that larger fragments are obtained, which were easier to use pathologically, avoid the missing histopathological examination of the fragments of broken tissue affecting the final pathological results [24].

The complication rate of hysteroscopic surgery depends mainly on the difficulty of the procedure, the equipment used, the technique, the surgeon's technique, and the patient's condition [25]. In this study, 202 patients underwent surgery successfully, and the lesions were completely removed at one time. A total of 2 cases of intraoperative complications occurred in the study, both of which were in the cold knife group, and no serious complications occurred. Due to the small sample size, this data was not statistically significant in this experiment. But previous research has shown that cold knife procedure needs to repeatedly enter and exit the uterine cavity to remove the tissue for a clear view, the operation time and the risk of cervical injury are increased [26]. Ascribe to continuous negative pressure suction of the excised tissue, the IBS® avoids these situations well.

It is well known that 'blind' procedures, such as too aggressive curettage, may damage the basal layer of the endometrium, leading to intrauterine adhesion formation (Asherman Syndrome) [27]. In this study, the average postoperative vaginal bleeding time (4.77±0.993 d) in the IBS group was significantly shorter than that in the cold knife group (5.09±1.252 d). Although there was no statistically significant difference in the postoperative endometrial thickness between the two groups, the average endometrial thickness of the IBS group was 8.012 mm, which was higher than that of the cold knife group of 7.505 mm. Due to the the IBS® system is free from 'blind' procedures, it has been able to selectively remove tissue under controllable direct visual and shaving depth with minimal injury and damage to the healthy endometrium [28].

Existing literature reports postoperative recurrence rates of 5.6-31.4% for uterine endometrial polyps [29, 30]. Cold knife resection because of the incomplete removal of polyps, polyps are prone to recurrence and residual after surgery. Previous research has showed that the IBS® Tissue Removal Device can accurately remove lesions through a shaving head for rapid and rotational cutting, while protecting the surrounding normal endometrium, reducing the recurrence and residual polyps [31]. The results of this study were consistent with previous findings that the recurrence rate was 6% (6/100) in the IBS group and 14.7% (15/102) in the cold knife group. There was no significant difference in pregnancy rates between

the two groups, which may be related to the larger mean age of the included patients.

The risk factors for endometrial polyp recurrence include: age≥35 years old, obesity, multiple polyps (the number of polyps≥2), polyp diameter≥2 cm, etc [5, 32], The multivariate analysis of endometrial polyp recurrence on the results of this study only show that polyp diameter is related to postoperative recurrence. We speculate that it may be related to a small sample size and a large mean age of patients.

This study shows that the safety and long-term efficacy of the IBS® Tissue Removal Device in treating endometrial polyps are significantly better than that of hysteroscopic cold knife resection, characterized by lower postoperative recurrence rates, shorter operation time and intraoperative bleeding, and shorter postoperative vaginal bleeding time. It provides more reference for the selection of treatment methods for endometrial polyps in the future.

There were also limitations in this study, including retrospective analysis and lack of randomization, and we plan to conduct prospective comparisons in the future to confirm the efficacy and superiority of IBS®. The amount of intraoperative uterine distension fluid was not included in this study, and only the pregnancy rate was considered for pregnancy, the pregnancy outcome was not described. The surgeons were not controlled for the same doctors, so the final results may be biased.

Conclusion

In conclusion, the IBS® Tissue Removal Device can reduce the postoperative recurrence rate, improve the perioperative index, and reduce the postoperative vaginal bleeding time. Its efficacy and safety is better than that of hysteroscopic cold knife resection in the treatment of polyp, but further research is still needed to provide evidence-based evidence.

Abbreviations

IBS®	Intergrated Bigatti Shaver
BMI	Body mass index
IGF-1	Insulin-like growth factor I
EP	Endometrial polyp
IUA	Intrauterine adhesions
HCG	Human chorionic gonadotropin
HPV	Human papilloma virus
TCT	Thinprep cytologic test
ECG	Electrocardiogram

Acknowledgements

Thank you to all colleagues and patients for participating in this study.

Author contributions

FPZ designed and performed the research and obtained ethics committee approval. FYW collected clinical data, performed the statistical analysis and wrote the manuscript. XF and RXC managed and collected clinical data. FPZ critically assessed the manuscript, revised the manuscript and approved it. All authors read, reviewed and approved the final manuscript.

Funding

This study was funded by the Application Foundation Project of Changzhou Science and Technology Bureau(No. CJ20220251), the Top Talent of Changzhou "The 14th Five-Year Plan" High-Level Health Talents Training Project (No.2022CZBJ085), and the third level of the sixth "333 High level Talent Training Project" in Jiangsu Province(NO.2022 3-4-162).

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Ethics Committee and Institutional Review board of Changzhou Maternal and Child Health Care Hospital Afliated to Nanjing Medical University (Changzhou, China; approved on 25/11/2021, ref: 202169). Written informed consent was obtained from all participants. We confrmed that all methods were performed in accordance with the relevant guidelines and regulation.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Changzhou Maternal and Child Health Care Hospital, Changzhou Medical Center, Nanjing Medical University, Changzhou, Jiangsu 213000, China

Received: 1 September 2024 / Accepted: 24 November 2024
Published online: 30 November 2024

References

1. Mansour T, Chowdhury YS, Endometrial P. 2023 Apr 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 32491756.
2. Weigel GM, Baison GN, Mihalov L, Mupombwa T. Prevalence of and risk factors for endometrial polyps among asymptomatic postmenopausal women with uterovaginal prolapse. Am J Obstet Gynecol. 2024 Aug 8:S0002-9378(24)00822-6. https://doi.org/10.1016/j.ajog.2024.08.001. Epub ahead of print. PMID: 39127165.
3. Nappi L, Indraccolo U, Di Spiezio Sardo A, Gentile G, Palombino K, Castaldi MA, Spinelli M, Greco P. Are diabetes, hypertension, and obesity independent risk factors for endometrial polyps? J Minim Invasive Gynecol. 2009 Mar-Apr;16(2):157–62. Epub 2009 Jan 21. PMID: 19162559.
4. Yang JH, Chen CD, Chen SU, Yang YS, Chen MJ. Factors influencing the recurrence potential of Benign Endometrial polyps after Hysteroscopic Polypectomy. PLoS ONE. 2015;10(12):e0144857. https://doi.org/10.1371/journal.pone.0144857. PMID: 26660149; PMCID: PMC4676604.
5. Liu J, Liang Y, Ouyang J, Yang S. Analysis of risk factors and model establishment of recurrence after endometrial polypectomy. Ann Palliat Med. 2021;10(11):11628–11634. https://doi.org/10.21037/apm-21-2747. PMID: 34872287.
6. Gu F, Zhang H, Ruan S, Li J, Liu X, Xu Y, Zhou C. High number of endometrial polyps is a strong predictor of recurrence: findings of a prospective cohort study in reproductive-age women. Fertil Steril. 2018;109(3):493–500. Epub 2018 Mar 7. PMID: 29525689.
7. Kosei N, Zakharenko N, Herman D, Endometrial polyps in, women of reproductive age: clinical and pathogene-tic variations. Georgian Med News. 2017;(273):16–22. PMID: 29328024.
8. Kitaya K, Tada Y, Taguchi S, Funabiki M, Hayashi T, Nakamura Y. Local mononuclear cell infiltrates in infertile patients with endometrial macropolyps versus micropolyps. Hum Reprod. 2012;27(12):3474-80. https://doi.org/10.1093/humrep/des323. Epub 2012 Sep 5. PMID: 22951914.
9. Serhat E, Cogendez E, Selcuk S, Asoglu MR, Arioglu PF, Eren S. Is there a relationship between endometrial polyps and obesity, diabetes mellitus.

Hypertension? Arch Gynecol Obstet. 2014;290(5):937–41. https://doi.org/10.1007/s00404-014-3279-4. Epub 2014 May 24. PMID: 24858564.
10. Reaven GM, Banting. lecture 1988. Role of insulin resistance in human disease. Diabetes. 1988;37(12):1595 – 607. https://doi.org/10.2337/diab.37.12.1595. PMID: 3056758.
11. Raz N, Feinmesser L, Moore O, Haimovich S. Endometrial polyps: diagnosis and treatment options - a review of literature. Minim Invasive Ther Allied Technol. 2021;30(5):278–87. Epub 2021 Aug 6. PMID: 34355659.
12. Cravello L, Stolla V, Bretelle F, Roger V, Blanc B. Hysteroscopic resection of endometrial polyps: a study of 195 cases. Eur J Obstet Gynecol Reprod Biol. 2000;93(2):131-4. https://doi.org/10.1016/s0301-2115(00)00281-5. PMID: 11074132.
13. Mencaglia L, Lugo E, Consigli S, et al. Bipolar resectoscope: the future perspective of hysteroscopic surgery. Gynecol Surg. 2009;6:15–20. https://doi.org/10.1007/s10397-008-0400-3.
14. Lee GY, Han JI, Heo HJ. Severe hypocalcemia caused by absorption of sorbitol-mannitol solution during hysteroscopy. J Korean Med Sci. 2009;24(3):532–4. https://doi.org/10.3346/jkms.2009.24.3.532. Epub 2009 Jun 18. PMID: 19543422; PMCID: PMC2698207.
15. Schäfer M, Von Ungern-Sternberg BS, Wight E, Schneider MC. Isotonic fluid absorption during hysteroscopy resulting in severe hyperchloremic acidosis. Anesthesiology. 2005;103(1):203-4. https://doi.org/10.1097/00000542-200507000-00029. PMID: 15983474.
16. Van Kruchten PM, Vermelis JM, Herold I, Van Zundert AA. Hypotonic and isotonic fluid overload as a complication of hysteroscopic procedures: two case reports. Minerva Anestesiol. 2010;76(5):373–7. PMID: 20395900.
17. Pasini A, Belloni C. Complicanze intraoperatorie di 697 isteroscopie operative consecutive [Intraoperative complications of 697 consecutive operative hysteroscopies]. Minerva Ginecol. 2001;53(1):13–20. Italian. PMID: 11279391.
18. Luerti M, Vitagliano A, Di Spiezio Sardo A, Angioni S, Garuti G, De Angelis C, Italian School of Minimally Invasive Gynecological Surgery Hysteroscopists Group. Effectiveness of Hysteroscopic Techniques for Endometrial Polyp Removal: The Italian Multicenter Trial. J Minim Invasive Gynecol. 2019 Sep-Oct;26(6):1169–76. https://doi.org/10.1016/j.jmig.2018.12.002. Epub 2018 Dec 7. PMID: 30528831.
19. Bigatti GIBS. Integrated Bigatti Shaver, an alternative approach to operative hysteroscopy. Gynecol Surg. 2011;8:187–91. https://doi.org/10.1007/s10397-010-0634-8®.
20. Yin X, Cheng J, Ansari SH, Campo R, Di W, Li W, Bigatti G. Hysteroscopic tissue removal systems for the treatment of intrauterine pathology: a systematic review and meta-analysis. Facts Views Vis Obgyn. 2018;10(4):207–13. PMID: 31367293; PMCID: PMC6658200.
21. Bigatti G, Ferrario C, Rosales M, et al. IBS® Integrated Bigatti Shaver versus conventional bipolar resectoscopy: a randomised comparative study. Gynecol Surg. 2012;9:63–72. https://doi.org/10.1007/s10397-011-0701-9.
22. Shazly SA, Laughlin-Tommaso SK, Breitkopf DM, Hopkins MR, Burnett TL, Green IC, Farrell AM, Murad MH, Famuyide AO. Hysteroscopic Morcellation Versus Resection for the treatment of Uterine Cavitary lesions: a systematic review and Meta-analysis. J Minim Invasive Gynecol. 2016 Sep-Oct;23(6):867–77. Epub 2016 May 7. PMID: 27164165.
23. Anastasiadis PG, Koutlaki NG, Skaphida PG, Galazios GC, Tsikouras PN, Liberis VA. Endometrial polyps: prevalence, detection, and malignant potential in women with abnormal uterine bleeding. Eur J Gynaecol Oncol. 2000;21(2):180-3. PMID: 10843481.
24. Istrate-Ofiţeru AM, Mogoantă CA, Zorilă GL, Roşu GC, Drăguşin RC, Berbecaru EI, Zorilă MV, Comănescu CM, Mogoantă SŞ, Vaduva CC, Brătilă E, Iliescu DG. Clinical characteristics and local histopathological modulators of endometriosis and its progression. Int J Mol Sci. 2024;25(3):1789. https://doi.org/10.3390/ijms25031789. PMID: 38339066; PMCID: PMC10855449.
25. Munro MG, Christianson LA. Complications of Hysteroscopic and Uterine Resectoscopic Surgery. Clin Obstet Gynecol. 2015;58(4):765 – 97. https://doi.org/10.1097/GRF.0000000000000146. PMID: 26457853.
26. Jansen F-W, Vredevoogd C, Ulzen K, Hermans J, Trimbos B, Trimbos-Kemper, Trudy. Complications of hysteroscopy: a prospective, multicenter study. Obstet Gynecol. 2000;96:266–70. https://doi.org/10.1016/S0029-7844(00)00865-6.
27. Hooker AB, Thurkow A. Asherman's syndrome after removal of placenta remnants: a serious clinical problem. Gynecol Surg. 2011;8:449–53. https://doi.org/10.1007/s10397-011-0677-5.
28. Ansari SH, Bigatti G, Aghssa MM. Operative hysteroscopy with the Bigatti shaver (IBS ®) for the removal of placental remnants. Facts Views Vis Obgyn. 2018;10(3):153–9. PMID: 31191850; PMCID: PMC6548414.
29. Qu D, Liu Y, Zhou H, Wang Z. Chronic endometritis increases the recurrence of endometrial polyps in premenopausal women after hysteroscopic polypectomy. BMC Womens Health. 2023;23(1):88. https://doi.org/10.1186/s12905-023-02232-3. PMID: 36841768; PMCID: PMC9960172.
30. Clark TJ, Stevenson H. Endometrial polyps and abnormal uterine bleeding (AUB-P): what is the relationship, how are they diagnosed and how are they treated? Best Pract Res Clin Obstet Gynaecol. 2017;40:89–104. https://doi.org/10.1016/j.bpobgyn.2016.09.005. Epub 2016 Oct 1. PMID: 27914969.
31. Franchini M, Ceci O, Casadio P, Carugno J, Giarrè G, Gubbini G, Catena U, Chiara de Angelis M, Di Spiezio Sardo A. Mechanical hysteroscopic tissue removal or hysteroscopic morcellator: understanding the past to predict the future. A narrative review. Facts Views Vis Obgyn. 2021;13(3):193–201. Epub 2021 Jun 10. PMID: 34555873; PMCID: PMC8823270.
32. Fang RL, Chen LX, Shu WS, Yao SZ, Wang SW, Chen YQ. Barcoded sequencing reveals diverse intrauterine microbiomes in patients suffering with endometrial polyps. Am J Transl Res. 2016;8(3):1581–92. PMID: 27186283; PMCID: PMC4859642.

Publisher's note