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CLINICAL ARTICLE

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Clinical analysis of 2152 cases of abnormal uterine bleeding treated by NovaSure endometrial ablation

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Abstract

Objective: To evaluate the efficiency, postoperative hysterectomy rate, and influencing factors for therapeutic effect of the NovaSure endometrial ablation procedure in abnormal uterine bleeding (AUB).

Methods: We conducted a retrospective cohort study of 2152 patients from the Department of Gynecology at the Third Xiangya Hospital, CSU from October 2010 to December 2018.

Results: From the first year to the eighth year after operation, annual effective rate was above 95.24%, and the differences were not statistically significant. There are statistically significant differences between the effective and ineffective groups with regard to age, intrauterine polyps, total length of the uterus, systemic coagulation disorder, and preoperative hemoglobin. A multivariate logistic regression analysis showed that the risk factors associated with systemic coagulation disorders ($P = 0.027$) and high total uterine length ($P = 0.003$) affected NovaSure efficacy in the treatment of AUB. By December 2019, the postoperative hysterectomy rate was 1.86% (40/2152) and the complication rate was 1.67% (36/2152).

Conclusion: NovaSure is a reliable treatment for AUB and serious medical complications because of its simple operation, low amount of bleeding, quick postoperative recovery, and safe and effective short-term and long-term efficacy. However, it should be carefully selected for patients with a total uterus length exceeding 10 cm.

KEYWORDS
abnormal uterine bleeding, endometrial ablation, NovaSure endometrial ablation

1 | INTRODUCTION

Abnormal uterine bleeding (AUB) is a common gynecological clinical symptom and disease. It is difficult to diagnose and treat AUB because of its diverse manifestations, long or short duration, and complex etiology. FIGO (the International Federation of Gynecology and Obstetrics) defines bleeding from the uterine cavity as AUB if it does not meet the normal standards in any of the four indicators:

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frequency and regularity of menstruation and the menstrual cycle; length of the period; duration of flow (days); and volume of monthly blood loss (milliliters).[1,2] The incidence of AUB is 11%–20% in the general population. With increase in age, the incidence of AUB is highest in perimenopausal women, which seriously affects their physical and mental health and daily life.[3]

In China, the NovaSure endometrial ablation system was introduced in 2010 for the treatment of AUB. In the existing clinical literature, there are few reports on the short-term and long-term efficacy of NovaSure in the treatment of AUB based on a large-sample analysis, especially for severe internal diseases and benign uterine space-occupying lesions (such as myoma of the uterus). To promote the accumulation of clinical experience, postoperative follow up was conducted on 2152 patients who received AUB with the NovaSure endometrial ablation system to evaluate the improvement in postoperative symptoms, as well as to explore the short-term and long-term clinical efficacy of NovaSure treatment and the factors influencing its therapeutic effect, to provide a reference for clinical treatment.

2 | MATERIALS AND METHODS

From October 2010 to December 2018, 2429 patients were admitted to the Department of Gynecology of the Third Xiangya Hospital of Central South University for AUB, and 2152 patients who met the inclusion and exclusion criteria were effectively followed up. Patients aged 15–20 years were associated with uremia. Chronic renal failure or even uremia is frequently accompanied by endocrine disturbances leading to AUB and symptoms of anemia. All 2152 patients signed the informed consent before surgery and were classified according to the FIGO "PALM-COEIN" classification system. The disease etiology and composition ratio of the patients are shown in Table 1. There was no significant difference in the results of surgical efficiency based on disease etiology ($P = 0.780$). A total of 544 patients were complicated with other systemic diseases; their surgical history is shown in Table 2. Patients with multiple comorbidities were counted by category. The Institutional Review Board/Ethics Committee ruled that approval was received for this study and all human participants gave written informed consent before the study began.

TABLE 1 Ratio of etiology and composition of 2152 patients with abnormal uterine bleeding by PALM-COEIN classification

PALM-COEIN classification system	No. of cases	Constituent ratio *n* (%)
AUB-P	286	13.29
AUB-A	171	7.95
AUB-L	160	7.43
AUB-C	95	4.41
AUB-O	1421	66.03
AUB-E	6	0.28
AUB-N	13	0.61

Abbreviation: AUB, abnormal uterine bleeding.

TABLE 2 Patients with abnormal uterine bleeding plus other systemic diseases ($n = 544$)

Other systemic diseases	*n*	Other systemic diseases	*n*
Renal complications [a]	150	Malignant tumor after treatment[d]	5
Hematological diseases [b]	37	Decompensated cirrhosis	3
Cardiovascular complications [c]	224	Pituitary microadenoma	2
Diabetes	53	Systemic lupus erythematosus	7
Thyroid dysfunction	21	Containing two or more complications (hypertension, diabetes mellitus, coronary heart disease, abnormal thyroid function, blood system disease)	42

[a]Renal complications (CKD1–4, $n = 42$; CKD5, $n = 80$; renal transplantation, $n = 23$; isolated kidney, $n = 2$; uremia combined with uremic heart disease, $n = 1$; nephrotic syndrome, $n = 2$).

[b]Hematological diseases (aplastic anemia, $n = 14$; hemophilia, $n = 1$; special thrombocytopenic purpura, $n = 11$; thrombocytopenia, $n = 8$; leucocythemia, $n = 1$; chronic myelogenous leukemia, $n = 1$; myelodysplastic syndrome, $n = 1$).

[c]Cardiovascular complications (hypertension, $n = 184$; coronary arteriosclerotic cardiopathy, $n = 12$; cerebral infarction, $n = 8$; heart disease after valve replacement, $n = 17$; after rupture of cerebral hemangioma, $n = 1$; congenital heart disease, $n = 1$; dextrocardia, $n = 1$).

[d]Malignant tumor after treatment (postoperative breast cancer, $n = 3$; gastric cancer 3 years after surgery, $n = 1$; after 22 years of treatment for choriocarcinoma, $n = 1$).

The inclusion criteria were as follows: (1) a pictorial bleeding assessment chart score of at least 100 and medical therapy has failed or is contraindicated; (2) completed desired child-bearing and were unwilling or unable to tolerate hysterectomy; (3) cervical and endometrial cancerous lesions were excluded; (4) uterine cavity with space-occupying lesions, such as diameters less than 2 cm, and submucosal fibroids should be type 0, I, or II; and (5) total length of uterus (by sounding) between 6.0 and 12 cm, width of uterine cavity (measured by the NovaSure device) 2.5 cm or more.

The exclusion criteria were as follows: (1) those who had been pregnant or had the desire to reproduce or an uncertain desire to reproduce; (2) acute infection of the genitourinary tract; (3) complete uterine perforation caused by anatomic or pathologic factors (not caused by NovaSure procedure); (4) total length of uterus less than 6.0 cm or more than 12 cm or width of uterine cavity less than 2.5 cm; and (5) severe uterine malformation or severe Asherman syndrome before the NovaSure insertion, so the NovaSure equipment cannot enter the uterine cavity or expand the reticular electrode.

The NovaSure endometrial ablation system was from Hologic (Hologic Inc., Marlborough, MA, USA), and the hysteroscopy

instruments were from Olympus (4.5 mm, 6.5 mm, 8.0 mm; KARL STORZ SE & Co. KG, Tuttlingen, Germany).

After emptying the bladder, the woman was placed in the lithotomy position and the vulva and vagina were sterilized after intravenous general anesthesia. The voyeur and cervical forceps were placed to hold the cervix (and dilate the cervix if necessary). Hysteroscopy was performed routinely to understand the shape, size, and intimal thickness of the uterine cavity. Endometrial polyps, submucosal fibroids, incomplete uterine mediastinum, and intrauterine adhesions were corrected using hysteroscopic electrotomy to restore normal uterine cavity morphology. Uterine aspiration was performed to remove thickened endometrium, intrauterine blood clots, and dilating uterine fluid, and the endometrial tissues were collected and sent for pathologic examination to further exclude precancerous and malignant endometrial lesions. The lengths of the uterine cavity and cervical canal were measured. A disposable bipolar ablation device was inserted into the uterine cavity to measure the width of the uterine floor. The length and width of the uterus were input into the controller. The integrity of the uterine cavity was detected, the generator was activated after the pressure test was passed, the three-dimensional bipolar radiofrequency endometrium removal was performed, and the surgical treatment time and blood loss were recorded. Hysteroscopy was performed again after surgery to investigate the endometrial removal, and residual endometrial tissue was electrocuted where necessary. Intraoperative and postoperative vital signs were closely monitored. Postoperative abdominal pain and vaginal bleeding were observed, and uterine perforation, infection, heat injury of adjacent tissues, hematuria, intestinal perforation, and other complications were recorded. No routine anti-infective therapy was performed after the operation. Patients with renal failure received blood/peritoneal dialysis as prescribed by the doctor before and after surgery.

A hysteroscopy was performed immediately after the NovaSure operation; the surfaces of the uterine cavity walls were scorched and the endometrium showed charred changes. Careful observation was made of the bottom of the uterus, the corners of both sides of the uterus, the opening of the fallopian tube and the cervical opening. Almost complete destruction of the endometrium was observed by hysteroscopy immediately after treatment in 1983 cases, and hysteroscopic endometrial resection was performed for supplementary resection in 169 cases. General information on the patient and surgery information are shown in Table 3.

After curative surgery, all of the patients were followed up at 1 month at the outpatient department; these patients were also followed up every 6 months or 1 year by telephone. The follow-up content included improvement of menstruation, anemia, vaginal drainage, dysmenorrhea, lower abdominal pain, and other postoperative symptoms. Routine blood examination and gynecologic B-ultrasound were performed.

Participants were asked to rate their menstrual bleeding after endometrial ablation as either No bleeding, Spotting, Light bleeding, Normal menses, or Heavy bloodflow.[4] Clinical effective rates, defined as normal-to-no bleeding. The indicators include the effective rate, which is the number of effective cases/total cases × 100%.

TABLE 3 General information of the patient and Surgery information with NovaSure[a]

Predictors		
Age, years	45.10 ± 4.43	15–57
Preoperative hemoglobin, g/L	99.11 ± 23.85	35–145
Hemoglobin after 1 month, g/L	114.03 ± 26.39	58–158
Uterine length, cm	8.69 ± 0.93	6–12
Uterine cavity length, cm	5.48 ± 0.67	4–8
Uterine cavity width, cm	4.42 ± 0.63	2.5–6.5
RF power, w	133.29 ± 27.88	29–180
Working time, s	63.28 ± 18.24	21–128
Blood loss, ml	5.32 ± 2.54	3–10

[a]Values are given as mean ± standard deviation or as range.

SPSS 19.0 (IBM Corp., Armonk, NY, USA) was used to analyze the results. The measurement data are presented by mean ± standard deviation, and the counting data are presented as percentage (%). Independent and paired sample *t* tests and χ^2 test, row × column χ^2 test, and Fisher's exact probability method were used for the statistical analysis, as well as a multivariate binary classification logistic regression analysis. Differences were considered statistically significant at $P < 0.05$.

3 | RESULTS

The postoperative hospital stay of 2152 patients ranged from 24 to 48 h. Within 72 h after surgery, 212/2152 (9.90%) patients complained of tolerable abdominal pain; 28/2152 (1.30%) of patients had severe abdominal pain but did not need painkillers. None of the patients showed symptoms of abdominal pain at the time of discharge.

The patients were followed up once a month after surgery and once a year thereafter. The average follow-up time was 3.86 ± 1.94 years, and the annual effective rates of years 1–8 were as follows: 2116/2152 (98.32%), 1773/1811 (97.90%), 1519/1559 (97.43%), 1171/1202 (97.42%), 808/832 (97.12%), 466/477 (97.69%), 219/227 (96.48%), and 40/42 (95.24%), respectively, which was efficient, with no difference between groups ($\chi^2 = 8.574$, $P = 0.285$). By December 2019, the hysterectomy rate was 1.86% (40/2152).

Among the 2152 patients, 772 (35.87%) had no symptoms of discomfort and 1356 (63.01%) had only a small amount of vaginal discharge after surgery. The discharge fluid gradually changed from hemorrhagic to pale yellow, clear and odorless, and lasted less than 1 month. In 24/2152 (1.12%) patients, the vaginal discharge lasted for more than 1 month after the operation. The amount of vaginal discharge was less than the normal menstrual flow; it was a light-yellow, watery secretion with no odor. Vaginal discharge was tolerated in all patients without further treatment.

Among the 2152 patients, a total of 36 postoperative complications were recored: one case of delayed intestinal perforation; five

cases of postoperative pelvic infection; 24 cases of intrauterine effusion; and six cases of post-ablation tubal sterilization syndrome. No urinary damage, gas embolism, sepsis, cardiac arrest, or other complications were noted.

Analysis of influencing factors on the therapeutic effect of NovaSure used a univariate analysis of the efficacy of NovaSure in the treatment of AUB. It showed that there were statistically significant differences in age, intrauterine polyps, total uterine length, systemic coagulation disorders, and preoperative hemoglobin values between the effective group and the ineffective group, as shown in Table 4.

According to the single factor analysis results, if the difference was statistically significant, then the indicator was used as an independent variable, with postoperative efficacy as the dependent variable, to assess the treatment of AUB risk factors in a multivariate logistic regression analysis. The results showed that the combination of whole-body blood coagulation disorder and uterine influence (total length of more than 10 cm) was associated with a curative effect of treatment of AUB risk factors, as shown in Table 5.

4 | DISCUSSION

Estrogen-progesterone combinations or progesterone-only contraceptives account for a large proportion of drug therapy, along with hemostatic agents, gonadotropin-releasing hormone analogs, and Mirena. However, oral hormones are contraindicated for some patients, including those with diabetes, breast cancer, and thrombotic diseases. If the menstrual process cannot be improved quickly, then the resulting anemia cannot be corrected quickly either, which will further aggravate the condition. Perimenopausal women are the main patients with AUB, and the risk of thrombosis gradually

TABLE 4 Single factor analysis of the effect of NovaSure on abnormal uterine bleeding[a]

Predictors	Effective group ($n = 2019$)	Invalid group ($n = 41$)	t/χ^2	*P* value
Age, years				
≤45	1050	27	4.24	0.039
>45	1061	14		
Submucosal myoma				
Yes	29	2	1.448	0.229
No	2082	39		
Polyps				
Yes	268	1	5.512	0.019
No	1843	40		
Clotting disorders				
Yes	90	5	4.264	0.039
No	2021	36		
Adenomyosis				
Yes	165	6	1.709	0.191
No	1946	35		
Uterine length, cm				
≥10	213	10	7.382	0.009
<10	1898	31		
Cavity width, cm	4.40 ± 0.63	4.43 ± 0.73	—	0.151
Preoperative hemoglobin, g/L	99.08 ± 23.81	95.07 ± 28.18	—	0.034

[a]Values are given as number or as mean ± standard deviation unless otherwise stated.

TABLE 5 Logistic regression analysis of risk factors for abnormal uterine bleeding treated with NovaSure

Predictors	Standard error	*P* value	OR (95% CI)
Age	0.032	0.261	0.97 (0.91–1.03)
Endometrial polyps	1.017	0.114	0.20(0.03–1.47)
Uterine length	0.142	0.003	1.52 (1.15–2.01)
Systemic coagulation disorders	0.494	0.027	2.99 (1.14–7.87)
Preoperative hemoglobin	0.007	0.598	1.01 (0.98–1.01)

Abbreviations: CI, confidence interval; OR, odds ratio.

increases with age, which greatly increases the risk of endometrial lesions compared with patients with AUB of childbearing age. If necessary, timely surgical treatment should be selected to clarify the pathologic conditions of the endometrium. In our study, 888 (62.49%) of 1421 patients with AUB-O (AUB due to ovulatory dysfunction) received conservative drug therapy, 285/1421 (20.06%) were treated with sex hormone drugs. Although Chinese guidelines regard drug therapy as the main method for AUB-O, endometrial removal not only meets the treatment needs of patients without fertility but also reduces the rate of hysterectomy for benign lesions in patients who do not respond to drug therapy, who require uterus preservation, or who cannot tolerate other treatments. In this study, there were 31 patients with submucosal fibroids, among whom 28 were associated with ovulatory dysfunction and three with coagulation disorder. As these were cases of AUB caused by multiple etiologies, only the treatment of submucosal uterine fibroids was not effective, requiring individualized diagnosis and treatment.

The first generation of endometrial removal is performed under hysteroscopy and is performed by clinicians who are skilled in hysteroscopy. NovaSure is the second generation of endometrial removal surgery; it does not require hysteroscopy for endometrial removal, which reduces the operation time and the incidence of surgical complications. Comparatively, it has considerable advantages in terms of technical requirements and surgical bleeding volume. This research shows that the short-term, mid-term, and long-term response rates of AUB treated by NovaSure were over 95%, and there was no significant difference in the annual response rates between 1 and 8 years after the operation ($\chi^2 = 8.574$, $P = 0.285$), suggesting that the medium term and long-term effects of the treatment of AUB after endometrial removal by NovaSure were relatively stable, and the treatment was reliable and effective in the short and long term. Gallinat, Nugent and colleagues[5-7] reported that at 12 months after treatment with NovaSure, more than 97.20% (104/107) of the patients had reduced menstrual volume and the rate of amenorrhea was nearly 59.81% (64/107), and at 60 months after the operation, 74.77% (80/107) of the patients had amenorrhea. De Leotoing et al.[8] reported that the effective rate of patients receiving NovaSure treatment reached 90.10% (5162/5731) at 18 months, 88.32% (4424/5009) at 24 months, and 81.10% (1364/1682) at 60 months. Bian Qian et al.[9] conducted a retrospective analysis of 199 patients and found that the effective rate of NovaSure after treatment was 97.99% (195/199). Various studies have supported the efficacy of NovaSure in the treatment of AUB with a low recurrence rate.

In our follow up to December 2019, the hysterectomy rate after surgery was 1.91% (41/2152). Wei Li-Ying et al.[10] reported a hysterectomy rate of 2.65% (4/151) in patients with menorrhagia treated with NovaSure, and Sun Xiaoli et al.[11] reported that the hysterectomy rate 12 months after surgery was 1.5% (2/135). At present, our study is in line with the current literature. Severe complications are actually relatively common among patients with AUB; for such patients, medication is prohibited and hysterectomy carries a huge risk. This can be challenging for the clinician, as these patients usually have a low desire for fertility and hope to receive safe and effective treatment, but the general patient condition is poor, making it more difficult to tolerate a hysterectomy. This study included 544 cases with other systemic diseases, including 217 cases with severe medical complications. The effective rate of NovaSure treatment was 96.77% (210/217), and compared with traditional hysterectomy, the time of NovaSure treatment was greatly shortened and the surgical injury was less. It can be seen from the follow-up results that for patients with AUB combined with uremia, cardio-cerebrovascular disease, liver disease, and blood system and other diseases, treatment with NovaSure impedance-controlled endometrial removal is safe.

NovaSure is a safe and effective minimally invasive surgical procedure that has become a well-established alternative to medical treatment or hysterectomy to treat AUB in select cases. It is safe and effective while favoring a minimally invasive approach. However, there should be a preoperative assessment to rule out any contraindication to endometrial ablation, but not limited to endometrial sampling and an assessment of the uterine cavity. All patients should also be followed up regularly after surgery.

The main reasons for hysterectomy after NovaSure treatment were abdominal pain, dysmenorrhea, and unsatisfactory improvement in menstrual volume. In the short term after the operation, the patient's menstruation decreased or even reached amenorrhea, but after a few months, abnormal vaginal bleeding appeared again. Although the menstrual volume of most patients was reduced compared with that before the operation, the patient could not physically tolerate it or could not achieve satisfactory psychological comfort.

In this study, the incidence of complications was 1.67% (36/2152). One case of intestinal perforation complication occurred at the initial stage of the introduction of NovaSure treatment in our hospital. The patient developed abdominal pain symptoms approximately 2 weeks after surgery and had not undergone other operations within that time. The patient's own intestinal lesions or the delayed febrile injury effect after the NovaSure operation may have caused the pain; however, no obvious perforation was observed on the uterine surface at the time of laparotomy. Six patients had postoperative chronic, periodic lower abdominal pain. Although their postoperative menstruation was significantly improved, the pelvic pain could not be endured and was diagnosed as postoperative syndrome of endometrium removal and tubal sterilization. Five patients finally underwent hysterectomy, and one patient was admitted to the local hospital for hysteroscopy and intrauterine electrotomy, which alleviated the postoperative abdominal pain. Twenty-four women were admitted for hysteroscopy or hysterectomy because of abdominal pain, vaginal fluid, or slight vaginal bleeding.

A number of studies have shown that compared with hysterectomy, second-generation endometrial removal procedures such as NovaSure have a lower incidence of serious complications, lower cost, and higher success rate.[12-14] A French study reported that the complication rate of second-generation endometrial removal was 1.9% (149/7863) 18 months after the operation, and it was 5.3% (5823/109 884) among women undergoing hysterectomy.[8] The NovaSure treatment process depends on the system itself, in addition to its safety inspection system. The condition of all patients

should be fully evaluated before surgery. All the qualified doctors in our hospital have great experience in hysteroscopic operations. Hysteroscopy was used to assess a patient's intrauterine environment before the treatment; septate uterus, submucosal or uterine fibroids, and intrauterine lesions such as membrane polyps needed to be prioritized. Uterine suction pretreatment was performed using a suction straw of 7- or 8-mm diameter, with negative pressure of 0.05–0.06 Mpa to suck out the uterine dilatation fluid, blood clots, and residual endometrial fragments detected by hysteroscopy. The NovaSure operation generally does not require pretreatment; however, according to studies by Songshu Xiao and Jianfa Jiang and their colleagues,[4,15] endometrial ablation pretreatment before the suction process, especially for endometrial thickening or thinning, leads to more complete and thorough lining removal and can increase the rate of amenorrhea— improving the operation effect and shortening the operation time. A hysteroscopic examination of uterine perforation and excessive uterine wall ablation was conducted after the operation; if the endometrium was not completely ablated, hysteroscopic endometrial resection was needed to improve the postoperative efficiency.

The present study showed that 24/2152 (1.16%) patients had vaginal discharge lasting more than 1 month, with no odor, and the amount was less than normal menstruation, which was basically tolerable for the women. Postoperative infection or endometritis is uncommon, and it has been reported that the incidence of postoperative endometritis varies from 0.6%[16] to 9.7%[17] in clinical studies. Five of the patients included in this study developed pelvic infection and were admitted to the hospital for active intravenous anti-infection treatment. After infection control, they were successfully discharged. The American College of Obstetricians and Gynecologists believes that the risk of postoperative infection is relatively small, so routine prophylactic antibiotic therapy is not recommended for ordinary patients receiving NovaSure.[18] However, prophylactic antibiotics should be considered in patients with a history of pelvic inflammation. The main adverse reactions during and after NovaSure surgery were vaginal bleeding and post-ablation tubal sterilization syndrome.

According to research,[19] post-ablation tubal sterilization syndrome may be related to endometrial sustainability or regeneration, and retrograde bleeding into the proximal blocked fallopian tube; changes in tubal pathology effusion can be seen under a microscope and include endometriosis, acute or chronic salpingitis, and acute or chronic uterine muscle inflammation. The longest follow-up in literature reports is more than a decade, and some Chinese studies have reported 1 year of postoperative follow-up of related cases. Six patients in the current study had a history of bilateral tubal sterilization surgery, which was 0.85% (6/704) of the patients with a history of tubal sterilization. Lower quadrant abdominal pain was significantly less during preoperative and postoperative menstruation 6 months to 2 years after surgery compared with that in the literature, which may be related to the postoperative endometrial regeneration ability in young patients. In the early postoperative period, six women had no menstruation, four had periodic gradual drip bleeding, six had uterine cavity effusion and fallopian tube effusion on B-ultrasonography, and five underwent hysterectomy for abdominal pain. The pathologic specimens after hysterectomy were observed. Hematoma of the bottom of the uterus, corners of both sides of the uterus, and fallopian tube were observed.

In one case, hysteroscopy and endometrial electrotomy were performed and postoperative abdominal pain was relieved. It was suggested that in the process of endometrial removal, in order to prevent the continuous presence of active endometrium at the fundus and the uterine horn, the endometrium of the uterine bottom and the uterine horn should be removed as completely as possible and supplemented by hysteroscopic endometrial resection if necessary. On the whole, treatment with NovaSure is safe, effective, and has few complications.

The multivariate logistic regression analysis showed that systemic coagulation disorders ($P = 0.027$) and high total uterine length ($P = 0.003$) were risk factors affecting the efficacy of NovaSure in the treatment of AUB. Postoperatively, patients with a long uterine cavity and NovaSure reported negatively correlated satisfaction.[20] The report by El-Nashar et al.[21] argues that age less than 45 years and a uterine cavity length greater than 9 cm are treatment failure risk factors for patients, which may be due to young patients having strong secretion hormones, ovarian and endometrial hyperplasia, and endometrial regrowth. The literature rarely reports cases of NovaSure treatment where the total uterine length is over 10 cm, which also suggests that clinicians should carefully evaluate the application of NovaSure treatment for patients with a large uterine cavity. The endometrium of patients with polyps is highly proliferative, which also affects the postoperative efficacy of NovaSure. Moreover, patients with low hemoglobin before the operation are mostly those with a systemic coagulation disorder and a total uterine length exceeding 10 cm. The second generation of endometrial resection in one prospective study showed subsequent endometrial pathology changes, with the occurrence of inflammation, necrosis, and myometrium contracture. Furthermore, muscle layers within blood vessels still carry risk, and although the initial curative effect among NovaSure postoperative cases is satisfactory, combined with clinical disorders of whole-body blood coagulation, clotting factors, or insufficient platelet function, bleeding could recur.[22]

Above all, after treatment of AUB with a short, simple operation, minimal damage, and other characteristics, the patient can obtain a significantly curative effect within a short period of time after surgery. At short-term and long-term follow up, the curative effect is both safe and effective for AUB and this is a reliable treatment for serious medical complications. However, patients with a total uterine length of more than 10 cm need to be fully informed of its possible adverse effects.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

AUTHOR CONTRIBUTIONS

SSX and HX conceived the study and drafted the manuscript. SX and YJW carried out the patient follow up. ZF and YJW participated in the design of the study and performed the statistical analysis. MX and MYY conceived the study, participated in its design and coordination, and helped draft the manuscript. All authors read and approved the final manuscript.

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