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Original Research

Clinical Predictive Factors of Failure of Hysteroscopic Endometrial Ablation: Retrospective Cohort Study at a Tertiary University Hospital

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Abstract

Background: Endometrial ablation is a safe and effective minimally invasive surgical procedure. Despite the high success rate of endometrial ablation for heavy uterine bleeding management, some patients experience persistent symptoms after the procedure, necessitating a hysterectomy. The aim of this study is to determine the pre-operative clinical predictive factors of failure of endometrial ablation in the management of uterine bleeding. **Methods**: Retrospective cohort study of endometrial ablation procedures performed for treating heavy uterine bleeding. **Results**: Ninety five patients were included in the study. The failure rate was 24.2%. There was a statistically significant association between ablation failure and fluid deficit ($p = 0.002$) and intra-operative blood loss ($p = 0.047$). There was a statistically significant moderate association between adenomyosis ($p = 0.003$, $\varphi = 0.37$) and failed endometrial ablation. However, the age, body mass index (BMI), parity, number of miscarriages, number of cesarean sections, uterine length, endometrial thickness and procedure duration had no significant association with endometrial ablation. There was no significant relationship between the uterine abnormalities in general and the outcome of the endometrial ablation ($p = 0.637$). However, patients with combined adenomyosis and dysmenorrhea had a statistically significant association with outcome of the endometrial ablation ($p = 0.016$, $\varphi = 0.28$) and were more likely to have a failed endometrial ablation (crude odds ratio (COR) = 4.67, 95% confidence interval (CI), 1.35–16.09). Logistic regression to adjust for related factors revealed that the adenomyosis (adjusted odds ratio (AOR) = 50.83, 95% CI, 3.64–706.75, $p = 0.003$) and fluid deficit (AOR = 1.003, 95% CI, 1.000–1.006, $p = 0.044$) had a higher likelihood of an unsuccessful outcome. Hysterectomy was performed in 47.8% of patients who had failure of the ablation. **Conclusions**: Among pre-operative factors, adenomyosis, fluid deficit and combined adenomyosis and dysmenorrhea were found to predict failure of hysteroscopic endometrial ablation. **Clinical Trial Registration**: It was registered in https://www.clinicaltrials.gov database with Identifier: NCT05483348.

Keywords: endometrial; ablation; hysteroscopic; rollerball; uterine; adenomyosis

1. Introduction

Endometrial ablation (EA) is a safe and efficacious endoscopic surgical procedure that has become a well-established alternative option in selected women with heavy and abnormal uterine bleeding [1]. In the United Kingdom, hysterectomy rates were significantly reduced over the past 20 years due to both improved medical treatment and increased use of EA techniques [2]. EA improves treatment access for those women who have abnormal uterine bleeding (AUB) and provides an alternative to radical procedures such as hysterectomy [3]. Hysterectomy was found to be associated with a higher risk than endometrial ablation of surgery for pelvic floor repair and stress urinary incontinence [3].

Despite the high success rate of endometrial ablation for uterine bleeding management, some patients experience persistent symptoms after the procedure, necessitating a hysterectomy. The characteristics of patients whose endometrial ablation fails had been studied by Kristin A Riley in a cohort study of 51 patients who had multiple variants assessed, including age, body mass index (BMI), parity and tubal ligation. The only statistically significant variant was age; it also revealed that endometriosis was the most common finding among patients who presented for hysterectomy after endometrial ablation; other findings included adenomyosis and leiomyomata [4]. Another retrospective cohort study of 968 women who had endometrial ablation between January 2007 and July 2009 compared the risk of treatment failure between women who had regular and irregular heavy uterine bleeding, concluding that pre-operative bleeding pattern has no effect on failure rates or the need for gynecological procedures after endometrial ablation [5]. A study that included 128 women who had endometrial ablation or resection was conducted to determine the perioperative factors that influenced the success of this hysteroscopic intervention It was found that the presence of submucosal myoma was found to increase the risk of subsequent surgery [6].

The first-generation hysteroscopic techniques namely, roller ball ablation, bipolar endometrial resection and laser ablation, all required visualization of the cavity for the entirety of the procedure [7]. Second generation techniques have been developed which do not require hysteroscopy and can be easily performed without requiring high levels of skill include bipolar radiofrequency, microwave and thermal balloon ablation, endometrial cryotherapy, and hydrothermal ablation [8].

The success of endometrial ablation was seen in 80.6% of cases [9]. On the other hand, failure rates of endometrial ablation, which were manifested as persistence of pain or bleeding, have reached 10–20% that required patients to undergo further interventions to handle their malady [10].

The objective of our study was to determine additional patient characteristics and the clinical predictive factors of failure of endometrial ablation and the need of subsequent gynecological procedure.

The primary outcomes were to determine the preoperative clinical predictive factors of failure of endometrial ablation in the management of uterine bleeding. Secondary outcomes were to search for any intra-operative predictive factors of failure of the procedure. Better understanding of the predictive factors of success or failure will help in proper counselling of patients and in decreasing the incidence of endometrial ablation failure and avoid further re-ablation or hysterectomy.

2. Methods

2.1 Study Design

A retrospective cohort study was conducted in a single tertiary center, Jordan University Hospital (JUH). Such a design enabled us to compare two populations of similar baseline characteristics for the exception of the one studied.

2.2 Population

Patients with heavy menstrual bleeding for 6 months who had trans-cervical hysteroscopic endometrial ablation in the period September 2016 to September 2021 and followed up for at least one year. Heavy bleeding was subjectively indicated by the patient as having prolonged cycles, using excessive pads, staining her underwear, affecting her usual activities, taking supplements to correct her low hemoglobin and the presence of clots. This bleeding pattern should be experienced by the patient for at least 3 months. Patients with hemoglobin of less than 10.5 g/dL were considered anemic.

2.3 Data Collection

Clinical data included age, BMI, parity, tubal ligation, uterine size/length (in weeks as determined by bimanual examination and uterine sound), endometrial thickness (in millimeters as measured by transvaginal ultrasound scan (U/S)), procedure duration, fluid deficits, presence of uterine abnormality as endometriosis, adenomyosis, leiomyomata and polyps or history of dysmenorrhea, menorrhagia, number of cesarean sections, history of uterine surgery; myomectomy, dilatation and curettage (D&C).

Patients who had resection or subsequently had a diagnosis of endometrial cancer or hyperplasia (both simple and those with atypia), those with intramural fibroids, patients with submucosal fibroids larger than 5 cm, patients with previous ablation, patients who had ablation using bipolar diathermy and those with incomplete or missing records or follow up were excluded from the study's target population.

2.4 Ethical Considerations

Patients' data was treated with the utmost of confidentiality. Moreover, all records were accessed through JUH's computers and under JUH's medical staff supervision ensuring that no data was copied or transferred to private storage sources. Any and all data that contributes to the recognition of patients' identities, such as names, phone numbers or addresses were either turned into codes or not be used at all. The study obtained approval of the institutional review board (IRB) committee at JUH (decision number 58/2022, dated 17/02/2022). It was also registered in https://www.clinicaltrials.gov database with Identifier: NCT05483348.

All women had general and gynecologic examination preoperatively and either had diagnostic hysteroscopy or trans-vaginal ultrasound (U/S) scan done by consultant gynecologists to accurately measure the uterine size, endometrial thickness and the size of the fibroids or polyps, or both before the hysteroscopic ablation.

A written informed consent was obtained from all patients included in this study. The consent included full explanation of the procedure, benefits, potential complications and risks.

2.5 Surgical Technique

Hysteroscopic ablation was performed in the post-menstrual period when the endometrium was very thin. In our practice, we not use pre-operative endometrial thinning agents. The operative hysteroscopy in our study was done using rigid, with 30 degrees angulated continuous flow hysteroscopy utilizing a monopolar rollerball. This necessitated the use of glycine 1.5% as a uterine distending medium in 3.0 Liter-bags. The monopolar resectoscope was sterilizable and reusable while the bipolar one was a single-use instrument, thus minimizing financial costs. The flow rate used was at 250 mL/minute. Myomectomy cases were performed using angled wire cutting loop electrodes. All patients had standardized 80 millimeter mercury (mmHg) of intra-uterine pressure during surgery with the use of the same automated glycine infusion pump. Patients had cervical dilatation done to 10 mm using Hegar dilators unless the cervix was already found to be dilated. Patients with uterine polyps or fibroids (submucosal (SM) type 0 and 1 only) [11]

Table 1. Comparison of failed and successful endometrial ablations in relation to different factors.

Variables	Failure		Success		*p* value	Effect size
	Mean	Standard deviation	Mean	Standard deviation		
Age	45.39	8.45	46.36	6.68	0.431	-
BMI	30.75	3.47	29.8	6.71	0.413	-
Parity	4.1	2.49	4.43	2.27	0.283	-
Miscarriage	0.81	0.87	1.23	1.6	0.51	-
N of cesarean sections	2	1.66	1.31	1.55	0.135	-
Uterine length (weeks)	9.57	2.48	8.59	1.91	0.057	-
Endometrial thickness (mm)	10.77	5.21	11.02	7.04	0.935	-
Procedure duration (min)	36.3	14.94	35.42	13.63	0.893	-
Fluid deficit (cc)	575	298.33	335.3	203.99	0.002	0.34
Blood loss (cc)	65.22	49.35	49.93	46.09	0.047	0.21

Notes: *p* values for the Parity and uterine length were calculated by independent sample *t*-test. All other items were subjected to Mann-Whitney Utest or Mann–Whitney–Wilcoxon (MWW/MWU) test. BMI, body mass index; mm, millimeter; min, minute; cc, cubic centimeter; N, number.

had their lesions first resected using a resectoscope loop followed by rollerball endometrial ablation (REA). Before the REA, all patients had curettage of the whole endometrial cavity to obtain tissue for histopathological examination and to thin the endometrial to enhance the thermal effect of the ablation. There were selected cases that had bipolar ablation and they were excluded from the study to have a homogenous study population. All procedures were performed by the same consultant gynecologist. Data was extracted from patients' clinical notes in the clinic, operative notes, admission and follow up visits' notes.

Data was extracted by using relevant International Classification of Diseases—Ninth revision (ICD-9) codes as well as Current Procedural Terminology (CPT) codes [12].

Patients included in this study experienced heavy uterine bleeding and underwent endometrial ablation. Successful cases were defined as patients' satisfaction with the procedure as indicated by amenorrhea or very light menstrual bleeding for 12 months at least. Failure was defined as patients' un-satisfaction necessitating subsequent gynecological procedures such as hysterectomy or repeat ablation within 12 months after the endometrial ablation. We did not assess the effect of the ablation on the post-operative hemoglobin level. We then determined those who were unsatisfied (recurrent heavy bleeding, dysmenorrhea) and those who ended up with repeated ablation, hormonal treatment and those who had hysterectomy after the ablation.

2.6 Statistical Analysis

Data analysis was performed using the IBM SPSS, version 28.0 (IBM Corp., Armonk, NY, USA) developed by Norman H. Nie, Dale H. Bent and C. Hadlai Hull. Categorical variables were summarized as frequencies and percentages. Participants were categorized into two groups according to their failure or success of the primary endometrial ablation. Pearson's Chi-square (χ^2) test and Fischer's exact test with crude odds ratios (COR) (95% confidence interval (CI)) was used to determine the association between categorical data. The phi coefficient (φ) was used as a measure of the strength of association.

Normality was assessed using the Shapiro-Wilk test. Independent samples *t*-test and Mann-Whitney *U* tests were used to determine the association between continuous data. The effect size was calculated depending on the test use by effect size r for Mann-Whitney *U*. Variables that showed potentially interesting associations from the univariate analysis were included in the binary logistic regression model in order to control for possible confounding factors, which were summarized using adjusted odds ratios (AOR) (95% CI). Statistical significance was defined as a *p*-value of less than 0.05.

3. Results

In total, there were 138 procedures were done in the study period. Ninety-five patients were included in this study; the age ranged from 29 to 52 years, with a mean age of 46.13 $\pm$ 7.11 years. Among the participants, the mean BMI was 29.97 $\pm$ 6.23, ranged from 18 to 56. Participants were categorized into two groups according to their failure or success of the primary endometrial ablation. Overall, 24.2% (n = 23) had a failed endometrial ablation with a subsequent gynecological procedure and 75.8% (n = 72) had a successful endometrial ablation with no further procedures required. Tables 1,2 show a comparison between patients with successful and those with failed endometrial ablation groups.

Our results showed a significant difference between patients with successful and failed endometrial ablations in regard to fluid deficit ($p = 0.002$) and blood loss during the surgery ($p = 0.047$); however, the age, BMI, parity, number of miscarriages, number of cesarean sections, uterine length, endometrial thickness and procedure duration had no significant difference between the two groups ($p > 0.05$).

Table 2. A comparison between the clinical characteristics of failed and successful endometrial ablation.

Variables	Total number (%)	Endometrial ablation		OR (95% CI)	*p* value
		Failure	Success		
Smoker (yes)	3/78 (3.8)	2/18 (11.1)	1/60 (1.7)	7.38 (0.63–86.60)	0.131
History of coagulation disorders (yes)	1/92 (1.1)	0/22 (0)	1/70 (1.4)	0.99 (0.96–1.01)	1
Use of anticoagulants (yes)	1/92 (1.1)	0/22 (0)	1/70 (1.4)	0.99 (0.96–1.01)	1
Previous tubal ligation (yes)	9/95 (9.5)	2/23 (8.7)	7/72 (9.7)	0.88 (0.17–4.59)	1
Uterine abnormalities				1.55 (0.26–9.16)	0.637
Polyps	43/84 (51.2)	7/21 (33.3)	36/63 (57.1)		
Fibroids	42/84 (50)	14/21 (66.7)	28/63 (44.4)		
Adenomyosis	6/84 (7.1)	5/21 (23.8)	1/63 (1.6)		
No abnormalities	6/84 (7.1)	2/21 (9.5)	4/63 (6.3)		
Endometriosis	3/84 (3.6)	0/21 (0)	3/63 (4.8)		
Thickened endometrium	3/84 (3.6)	0/21 (0)	3/63 (4.8)		
Leiomyomata	1/84 (1.2)	1/21 (4.8)	0/63 (0)		
Menstrual abnormalities				0.38 (0.08–1.83)	0.349
Menorrhagia	79/89 (88.8)	18/21 (85.7)	61/68 (89.7)		
Dysmenorrhea	7/89 (7.9)	2/21 (9.5)	5/68 (7.4)		
Intermenstrual spotting	1/89 (1.1)	0/21 (0)	1/68 (1.5)		
History of uterine surgery				0.66 (0.23–1.90)	0.440
Dilation and curettage	51/91 (56)	15/22 (68.2)	36/69 (52.2)		
Evacuations	7/91 (7.7)	0/22 (0)	7/69 (10.1)		
Myomectomy	4/91 (4.4)	0/22 (0)	4/69 (5.8)		
Other	7/91 (7.7)	0/22 (0)	7/69 (10.1)		
No	31/91 (34.1)	6/22 (27.3)	25/69 (36.2)		
Indication for primary endometrial ablation					
Menorrhagia	36/95 (37.9)	12/23 (52.2)	24/72 (33.3)	2.18 (0.84–5.66)	0.139
Heavy menstrual bleeding	31/95 (32.6)	4/23 (17.4)	27/72 (37.5)	0.35 (0.11–1.14)	0.081
Fibroid	17/95 (17.9)	8/23 (34.8)	9/72 (12.5)	3.73 (1.24–11.29)	0.026
Irregular vaginal bleeding	14/95 (14.7)	2/23 (8.7)	12/72 (16.7)	0.48 (0.10–2.30)	0.506
Polyps	10/95 (10.5)	0/23 (0)	10/72 (13.9)	–	0.112
Postmenopausal bleeding	9/95 (9.5)	2/23 (8.7)	7/72 (9.7)	0.88 (0.17–4.59)	1
Infertility	3/95 (3.2)	1/23 (4.3)	2/72 (2.8)	1.59 (0.14–18.40)	0.569

There might be more than one indication. OR, odds ratio; CI, confidence interval.

Table 1 shows the details of the successful and failed endometrial ablations.

There was no significant relationship between the uterine abnormalities in general and the outcome of the endometrial ablation ($p = 0.637$); however, there was a statistically significant, moderate association between adenomyosis and the outcome of the endometrial ablation ($p = 0.003$, $\varphi = 0.37$) and were more likely to have a failed endometrial ablation COR = 19.38, 95% CI, 2.11–177.73) (Table 2). In addition, patients with combined adenomyosis and dysmenorrhea had a statistically significant association with the outcome of the endometrial ablation ($p = 0.016$, $\varphi = 0.28$) and were more likely to have a failed endometrial ablation (COR = 4.67, 95% CI, 1.35–16.09).

Menorrhagia and heavy irregular menstrual bleeding were among the most common indications for endometrial ablation in 37.9% and 32.6% of the patients, respectively. Moreover, the patients who underwent endometrial ablation due to fibroids (17.9%) had a significant weak relationship with the outcome of the endometrial ablation ($p = 0.26$, $\varphi = 0.25$), they were more likely to have a failed endometrial ablation (COR = 3.73, 95% CI, 1.24–11.29). Other indications included irregular vaginal bleeding, polyps, postmenopausal bleeding, and infertility and they no longer sought pregnancy and would only treat their heavy periods.

We also found that patients who had both adenomyosis and dysmenorrhea were at higher statistically significant risk to have ablation failure than those with adenomyosis alone, p value = 0.016, 95% CI, 1.51–50.69 and p value= 0.003, $\varphi = 0.37$, respectively.

Overall, 24.2% had a failed endometrial ablation and had to undergo an additional procedure to alleviate the symptoms. The most common were repeated hysteroscopic ablation and hysterectomy, in 15 and 11 patients, respectively (Table 3).

In order to account for any confounding effects, the variables having significant associations at the $p < 0.1$ level from the univariate analysis were included in the logistic

Table 3. Subsequent gynecological procedures after failed ablation (N = 23).

Surgeries	N (%)
Hysterectomy	11 (47.8)
Hysteroscopy and repeated ablation	15 (65.2)
Dilation and curettage (endometrial biopsy)	9 (39.1)
Other	5 (21.7)

Some patients underwent more than one procedure. N, number.

regression model. These were the uterine length in weeks, fluid deficit, blood loss, diagnosis of adenomyosis, heavy menstrual bleeding and fibroid(s). The significant predictors for endometrial ablation failure were adenomyosis (AOR = 50.83, 95% CI, 3.64–706.75, $p = 0.003$) and fluid deficit (AOR = 1.003, 95% CI, 1.000–1.006, $p = 0.044$). The uterine length in weeks, blood loss, indication for primary endometrial ablation being heavy menstrual bleeding, or presence of fibroid were not significant predictors in the regression model, which had a Pseudo Nagelkerke R Squared of 0.49. Table 4 demonstrates the regression model results for an endometrial ablation failure prediction.

Table 4. The results of regression model for endometrial ablation failure.

Variables	AOR	95% CI	*p* value
Uterine length (weeks)	1.069	0.704–1.622	0.755
Fluid deficit (mL/cc)	1.003	1.000–1.006	0.044
Blood loss (mL/cc)	1.004	0.991–1.018	0.505
Adenomyosis	50.825	3.655–706.745	0.003
Heavy menstrual bleeding	0.295	0.043–2.015	0.213
Fibroid	3.224	0.585–17.754	0.179

AOR, adjusted odds ratios; CI, confidence interval; mL, milliliter; cc, cubic centimeter.

4. Discussion

The overall success rate of our endometrial ablation procedures using the firstly generation rollerball ablative technique, REA, was very much good, acceptable and very helpful in a third world country with limited resources. When compared with hysterectomy, the treatment of AUB with endometrial ablation has been associated with reduced operative time, decreased morbidity, and cost effectiveness [13,14].

Over half of patients treated with microwave endometrial ablation (MEA) achieved amenorrhea, and the procedure was suitable for women with myomas and irregular uterine cavities and the success rate of MEA at 12 months (87.0%; 95% CI, 81.7%–91.2%) did not differ significantly ($p = 0.40$) from that of REA (83.2%; 95% CI, 74.7%–89.7%) [15].

Our study showed an overall failure rate of 24.2%. All patients were operated upon using either general or spinal anesthesia with no reported serious complications like perforation, bleeding or significant fluid absorption. When second-generation versus first-generation techniques were compared, there was no evidence of differences in amenorrhea at 1 year and 2 to 5 years' follow-up and there was subjective improvement at 1 year follow-up based on a Pictorial Blood Assessment Chart (PBAC) [16]. Moreover, patient satisfaction was not different between second- and first-generation techniques at 1 year, 2 years and 5 years' follow-up. Second-generation ablation techniques were associated with shorter operating times and more often were performed under local instead of general anaesthesia [16]. There was uncertainty whether perforation rates differed between second- and first-generation techniques [16]. Trials reported little or no difference between second- and first-generation techniques in requirement for additional surgery (ablation or hysterectomy) at 1 and 5 years' follow-up [16]. These findings support our practice in using first generation ablation as newer generations (second and third) are expensive and not readily available in our country. Similarly, levonorgestrel intra-uterine system (LNG-IUS) is still expensive in Jordan and not covered by many medical insurance companies. In a meta-analysis in 2020, endometrial ablation and LNG-IUS were found to be two excellent treatment options for heavy menstrual bleeding, although women treated with the LNG-IUS were at higher risk of experiencing side effects compared to women treated with endometrial ablation/resection [17]. This is very encouraging to us to further implement endometrial ablation in our practice taking into consideration the global and, particularly, the local economic restrictions. Similarly, in a review, when compared to endometrial ablation, it was not clear whether the LNG IUS offered any benefits with regard to reduced heavy bleeding while satisfaction rates and quality of life measures were found to be similar. In the same review, some minor adverse effects were more common with the LNG IUS but it appeared to be more cost effective than endometrial ablation techniques [18]. Hysterectomy was found to cause serious complications for a minority of women and most women might be well advised to try a less radical treatment as first-line therapy and it was found that both LNG-IUS and conservative surgery (ablation/resection) appeared to be safe, acceptable and effective [19]. Unfortunately, there were no studies in Jordan that compared these different modalities regarding particularly cost-effectiveness and patient satisfaction. There is an ongoing a multicenter randomized controlled trial to evaluate if the combination of endometrial ablation and an LNG-IUS is superior to endometrial ablation alone in terms of reducing subsequent rates of hysterectomy at two years following the initial ablative procedure [20].

Our study found a significant association between greater operative blood loss and fluid absorption (fluid deficit), as independent factors, with endometrial ablation

failure. The presence of adenomyosis and uterine fibroids as indication of endometrial ablation was also found to be significantly associated with the outcome of the endometrial ablations. However, the patient's age, BMI, parity, miscarriage, previous cesarean sections, uterine length (in weeks), endometrial thickness (in millimeters mm), dysmenorrhea and procedure duration (minutes) were not found to influence the effectiveness of the procedure. Some but not all of these findings were consistent with previous studies. Previous Cesarean delivery was not associated with an increased risk of failure of endometrial ablation, but dysmenorrhea, a submucous myoma and longer uterine depth are [21]. Their definition of failure was those patients who had ablation and hysterectomy. In our study, we did not specify hysterectomy as the only destination for failure definition. Moreover, dysmenorrhea cases in our study were only seven in both failed and successful cases. This low number might have influenced the statistical result.

We had a total of 6 cases of adenomyosis who had ablation; one was successful while the remaining 5 were a failure. There was no statistically significant difference in the outcome in our study concerning the success or failure of ablation. This might be due to the low number of cases or to the degree of junctional zone changes. In fact, the effect of transcervical endometrial resection might depend upon the degree of junctional zone changes, and patients with intrinsic adenomyosis were more likely to undergo re-intervention surgery than patients with either linear or serrated junctional zone [22]. However, hysteroscopic rollerball endometrial ablation as a surgical management in patients with adenomyosis associated with menorrhagia was found to be an effective and safe procedure which could reduce the need for the unnecessary major surgery of hysterectomy [23].

In a systemic review and meta-analysis [10], younger age, prior tubal ligation and preexisting dysmenorrhea were found to be associated with failure of endometrial ablation. Obesity and large submucous fibroids showed conflicting results and there was a need for further research to estimate the influence of these factors. This meta-analysis involved studies that were different from ours. The studies involved in this meta-analysis were using second generation endometrial ablation [10].

Our study did not show a statistically significant difference in ablation failure or success regarding preoperative menstrual irregularities and intermenstrual spotting. These findings were similar to a retrospective cohort study of a relatively large number of patients (968) [5].

As the first- and second- generation ablation techniques are effective and safe, we can expand our hysteroscopic endometrial ablation service to decrease the need for hysterectomy and particularly useful for patients with contraindications for medical therapy [24]. Both seem to be equally effective in reducing heavy bleeding and there was no evidence that rates of satisfaction differed significantly [25]. Despite second-generation techniques were often found to be easier to perform with shorter operative times with the ability to use local rather than general anesthesia and complications appeared to be less after second-generation techniques, the easiness of use can be a pitfall [25]. In fact, our experience with the first-generation technique showed that in expert hands and with strict adherence to energy settings and fluid management, significant complications could almost be eliminated.

Endometrial resection and ablation were effective alternative to hysterectomy for heavy menstrual bleeding and both were shown to have high satisfaction rates. Hysterectomy was associated with longer operating time, longer recovery period and higher rates of postoperative complications [26]. These features further support the incorporation of endometrial ablation service particularly in developing and under-resourced countries with limited financial, technical and medical capabilities to deal with complications.

In our practice, for endometrial ablation, we use the monopolar rollerball rather than the resectoscope. For bipolar resectoscope, in a randomized clinical trial, no significant difference was found in the postoperative PBAC score, amenorrhea rates, patient satisfaction, and need for re-intervention between ball endometrial ablation and transcervical resection of the endometrium using resectoscope [27]. This might have further explained the success and low complication rates in our study.

We did not assess post-ablation pain in our study as we followed patients for one year. It was reported in 20.8% of cases and the median number of days for the development of pain after ablation was 301 days [28].

The strengths of our study lied in the consistency of the study population and of the surgical technique. Moreover, the low cost of the procedure was a feature as no preoperative thinning agents were used and, instead, whole endometrial cavity curettage was utilized to obtain tissue for assessment and to mechanically and instantly thin the endometrium to increase the effectiveness of the thermal damage on the endometrium.

Study Limitations

The study was limited by its retrospective nature and being a single-center study. The post-operative follow up was another limiting feature.

5. Conclusions

Among pre-operative factors, adenomyosis, fluid deficit and combined adenomyosis and dysmenorrhea were found to predict failure of hysteroscopic endometrial ablation.

Abbreviations

BMI, body mass index; EA, endometrial ablation; AUB, abnormal uterine bleeding; JUH, Jordan university hospital; g, gram; mL, milliliter; dL, deciliter; D&C, dilata-

tion and curettage; IRB, institutional review board; U/S, ultrasound; mmHg, millimeter mercury; REA, rollerball endometrial ablation; ICD, international classification of diseases; CPT, current procedural terminology; COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval; mm, millimeter; min, minute; cc, cubic centimeter; MEA, microwave endometrial ablation; PBAC, pictorial blood assessment chart; LNG-IUS, levonorgestrel intrauterine system; SM, submucosal.

Availability of Data and Materials

All data are available from the corresponding author on reasonable request.

Author Contributions

NA—design, concept and writing the manuscript; AA—statistical analysis and extraction of data; RN—statistical analysis and extraction of data; LA—statistical analysis and extraction of data; MA—statistical analysis and extraction of data; HA—drafting and revision. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Jordan University hospital decision number 58/2022, dated 17/02/2022.

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Conflict of Interest

The authors declare no conflict of interest.

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