

## ORIGINAL ARTICLE

# Efficacy and prognosis of fertility-preserved hysteroscopic surgery combined with progesterone in the treatment of complex endometrial hyperplasia and early endometrial carcinoma

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## Summary

**Purpose:** To evaluate the complete response (CR) rate, recurrence rate and pregnancy outcome of complex endometrial hyperplasia (CEH) and early endometrial carcinoma (EC) patients treated with hysteroscopic surgery combined with progesterone, and to analyze the related influencing factors for prognosis.

**Methods:** The clinical data of 96 patients histopathologically diagnosed with CEH or early EC and treated with hysteroscopic surgery combined with levonorgestrel-releasing intrauterine system (LNG-IUS) and/or high-efficient megestrol acetate (MA) in our hospital from January 2014 to January 2016 were retrospectively analyzed. The hysteroscopic examination was performed for patients, and the improvement of endometrium was evaluated via curettage every 3 months after treatment. The recurrence, pregnancy and fertility conditions after CR were recorded through follow-up, and the influencing factors for prognosis were analyzed.

**Results:** Among the 96 patients, there were 83 cases (86.5%) of CR and 11 cases (13.3%) of recurrence. Among the CR

patients, 76 cases had the desire for pregnancy, and there were 46 cases (60.5%) of natural pregnancy or pregnancy using assisted reproductive technology after treatment. CR was achieved more easily in patients with a body mass index (BMI) <30 kg/m<sup>2</sup>. Moreover, the BMI <30 kg/m<sup>2</sup> and pregnancy after CR could reduce the recurrence rate, and BMI <30 kg/m<sup>2</sup> and assisted reproductive technology could improve the pregnancy outcome after remission.

**Conclusions:** For CEH and early EC patients who strongly urge to preserve the fertility, hysteroscopic surgery combined with LNG-IUS and/or high-efficient progesterone can obtain satisfactory efficacy. Strictly controlling the body weight of patients with BMI ≥30kg/m<sup>2</sup> can improve the remission rate and pregnancy rate and reduce the recurrence rate. Timely pregnancy after remission can reduce the recurrence rate, and the application of assisted reproductive technology can significantly enhance the pregnancy rate and live birth rate.

**Key words:** complex endometrial hyperplasia, early endometrial carcinoma, hysteroscopic surgery, progesterone

## Introduction

Endometrial carcinoma (EC) is one of the most common malignant tumors in the female genital tract, and its precancerous lesion is atypical endometrial hyperplasia, especially complex endometrial hyperplasia (CEH) [1]. Studies have demonstrated

that if there is no intervention treatment for CEH patients, about 29% of patients will develop cancer within 15 years under the continuous action of estrogens [2]. Although postmenopausal women are still the high-risk group of EC, 3-14% of EC occurs in

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women of childbearing age below 40 years old, and such a proportion increases year by year. More than 70% of patients have no reproductive history [3,4].

Total hysterectomy + bilateral adnexectomy + pelvic lymphadenectomy is a traditional treatment means for CEH and EC, but it deprives patients of the fertility and seriously affects the quality of life, contrary to the strong desire of most patients for preserving fertility [5]. Young EC patients are often accompanied by obesity, polycystic ovary syndrome, anovulatory menstrual cycle, infertility and other unopposed estrogen exposure conditions, the endometrial lesions are mostly focal and highly differentiated without myometrial invasion, and the progesterone receptor is usually positive, which makes the progesterone treatment possible [6]. In recent years, a number of foreign clinical studies have reported that the patient's fertility is preserved and the prognosis is good in the treatment of EC with hysteroscopic surgery combined with progesterone [7-9].

In the present study, the prognosis of tumor and pregnancy outcome of CEH and early EC patients treated with hysteroscopic surgery combined with levonorgestrel-releasing intrauterine system (LNG-IUS) and/or high-efficient progesterone [megestrol acetate (MA)] were evaluated, and the related influencing factors for prognosis were analyzed, hoping to provide more evidence for the fertility-preserved treatment for such patients.

## Methods

### General data

The clinical data of 96 patients treated in our hospital from January 2014 to January 2016 were retrospectively analyzed. All patients underwent hysteroscopic surgery and pathologically diagnosed with CEH or EC.

The median age of patients was 33 years old (21-40 years old), and there were 59 CEH patients and 37 EC patients, with the main chief complaints of irregular menstruation, prolonged menstrual cycle, prolonged bleeding or infertility. Inclusion criteria: patients aged  $\leq 40$  years old, those with CEH histological type or highly-differentiated endometrioid adenocarcinoma, those with a strong desire for fertility and able to be closely followed up, those without myometrial invasion, cervical involvement and extrauterine lesions according to magnetic resonance imaging (MRI), those with blood CA125  $< 35$  U/mL and positive progesterone receptor, and those without contraindications for LNG-IUS or progesterone. There were no statistically significant differences in the age, body mass index (BMI), pathological type, menstrual status, complications and family history among patients (Table 1). All patients enrolled conformed to the *Declaration of Helsinki*, and signed the informed consent. This study was approved by the Ethics Committee of Linyi Central hospital.

### Treatment methods

According to different therapeutic regimens, the 96 patients enrolled were divided into hysteroscopic surgery + LNG-IUS group (LNG-IUS group,  $n=32$ ), hysteroscopic surgery+high-efficient MA group (MA group,  $n=32$ ) and LNG-IUS+MA group ( $n=32$ ).

Hysteroscopic surgery: After satisfactory anesthesia, the uterus was expanded using the #10-12 uterus-expanding rod, and filled with 1.5% glycine solution under 70 mmHg. Then, 10 mm resectoscope was placed to cut the endometrial lesions and shallow myometrium at a depth of 2-3 mm under the lesions using 5 mm electric cutting ring under the output power of 100 W. In LNG-IUS group, LNG-IUS was placed in the uterine cavity at 3-7 d after operation. In MA group, MA was orally taken (160-320 mg/d). Those patients complicated with insulin resistance or diabetes took metformin orally according to the conditions.

### Observation indexes

The patients were reexamined once every 3 months, including blood biochemistry, ultrasound or MRI, hys-

**Table 1.** Baseline demographic and clinical characteristics of the studied patients

Characteristics	LNG-IUS group ( $n=32$ ) $n$ (%)	MA group ( $n=32$ ) $n$ (%)	LNG-IUS + MA group ( $n=32$ ) $n$ (%)	$p$ value
Age, years	33.34 $\pm$ 7.02	32.56 $\pm$ 7.81	32.18 $\pm$ 6.82	0.808
BMI (kg/m <sup>2</sup> )	28.83 $\pm$ 5.34	29.47 $\pm$ 4.59	28.33 $\pm$ 5.90	0.691
Irregular menstruation	26 (81.3)	28 (87.5)	25 (78.1)	0.606
PCOS	9 (28.1)	11 (34.4)	12 (37.5)	0.720
Infertility	10 (31.3)	8 (25.0)	11 (34.4)	0.708
Insulin resistance	11 (34.4)	7 (21.9)	14 (43.8)	0.177
Pathological type				0.565
CEH	18 (56.3)	19 (59.4)	22 (68.8)	
EC	14 (43.7)	13 (40.6)	10 (31.2)	
Family history of cancer	4 (12.5)	7 (21.9)	9 (28.1)	0.301

LNG-IUS: Levonorgestrel-releasing intrauterine system; MA: Megestrol acetate; BMI: Body Mass Index; PCOS: Polycystic ovary syndrome; EC: Endometrial carcinoma; CEH: Complex endometrial hyperplasia

teroscopic lesionectomy or curettage were performed, and the endometrial tissues obtained were sent for pathological examination to evaluate the therapeutic effect. According to the histopathological response after treatment, the therapeutic effect was divided into complete response (CR: no residual cancer tissues or hyperplastic tissues in the surgical specimen, with atrophy of endometrial glands, and decidual stromal reaction), partial remission (PR: endometrial hyperplastic changes, and no atypical cells), stable disease (SD: no changes in histopathology and treatment), progressive disease (PD: cancer cells emerge in patients, or moderately- and poorly-differentiated EC occur in highly-differentiated patients, or myometrial invasion or extrauterine metastasis suggested in imaging examination), and recurrence (atypical endometrial hyperplasia or cancer cells emerge again in the patient's tissue specimens after CR).

After treatment, all patients were followed up to detect the remission of lesion tissues, time of CR, recurrence, pregnancy, fertility and incidence of adverse reactions. After CR, the treatment was consolidated for 1-2 courses. If the patients had the desire for pregnancy, they were encouraged. It is recommended that the patients whose natural pregnancy was constantly failed be treated in the Department of Reproductive Medicine in time, and the assisted reproductive technology (ART) be adopted if necessary. For patients who temporarily had no plan for pregnancy after CR, it was recommended that the LNG-IUS be placed in the uterine cavity, or the short-acting contraceptives or second-half progesterone be orally taken for maintenance treatment to prevent recurrence. If the endometrial lesions had no remission in the return visit at 6 months after treatment, the surgical treatment was suggested. If the patients still strongly requested for conservative treatment, the treatment could continue for 3 months and hysteroscopy could be performed for pathological examination. If the lesions had no remission at 9 months after treatment, hysterectomy was suggested. In the case of PR at 9 months after treatment, the conservative treatment could continue for another one course, and hysteroscopy could be performed again for pathological examination. The surgical treatment was recommended for long-term SD or PD

patients. In the case of recurrence after CR, conservative treatment or direct surgery could be chosen for patients as their wish.

Statistics

SPSS 22.0 software (IBM, Armonk, NY, USA) was used for statistical analysis. The measurement data were expressed as mean ± standard deviation (x±s), and t-test was performed for two groups comparison. The overall differences in indexes of three groups were analyzed using one-way ANOVA, and LSD-t test was used for pairwise comparison. The enumeration data were expressed as rates (%), and x<sup>2</sup> test was performed for the intergroup comparison. Univariate and multivariate Cox regression analyses were adopted for the correlation analysis. P<0.05 suggested statistically significant difference.

Results

Comparison of short-term efficacy

Among the 96 patients treated, there were 83 cases (86.5%) of CR, including 29 EC patients (34.9%) and 54 CEH patients (65.1%). There were no statistically significant differences in the number of CR cases and the time of CR among patients receiving different therapeutic regimens (p=0.536, p=0.708). The time of CR in all patients was 3-14 months with a median of 5.3 months. CR was achieved in a total of 58 cases (69.9%) within 6 months, including 20 EC patients (34.5%) and 38 CEH patients (65.5%). CR was achieved within 6-12 months in 23 cases (27.7%), and after 12 months in 2 cases (2.4%). Thirteen patients always had no CR, and PR was achieved in 3 EC patients at 6 months after treatment and in 4 patients (2 EC cases and 2 CEH cases) at 9 months after treatment. In the reexamination for 4 patients (2 EC cases and 2 CEH cases) at 6 months after treatment, no changes were found in the pathological examination of endometrial tissues compared with that before treat-

Table 2. Comparison of tumor response, recurrence and pregnancy outcomes of patients in the studied patients

Parameters	LNG-IUS group (n=32) n (%)	MA group (n=32) n (%)	LNG-IUS + MA group (n=32) n (%)	p value
Tumor response				0.536
Complete response (CR)	26 (81.3)	29 (90.6)	28 (87.5)	
Not CR	6 (18.7)	3 (9.4)	4 (12.5)	
Time to CR, months				0.708
≤6	18 (69.2)	19 (65.5)	21 (75.0)	
6-12	7 (26.9)	10 (34.5)	6 (21.4)	
≥12	1 (3.9)	0 (0)	1 (3.6)	
Recurrence	5 (19.2)	3 (10.3)	3 (10.7)	0.663
Pregnancy	14 (56.0)	17 (65.4)	15 (60.0)	0.789
Give birth to neonate	9 (64.3)	13 (76.5)	8 (53.3)	0.389

LNG-IUS: Levonorgestrel-releasing intrauterine system; MA: Megesterole acetate

ment. Transformation of highly-differentiated cancer cells into moderately- and poorly-differentiated cells was found in 1 EC patient at 6 months after treatment, and cancer cells were observed in endometrial tissues in 1 CEH patient at 9 months after treatment. All the above 13 patients underwent surgery. According to the results of univariate and multivariate regression analysis, BMI  $\geq 30$  kg/m<sup>2</sup> was an independent risk factor affecting CR after treatment (Tables 2 and 3).

#### Recurrence after CR

Among the 83 CR patients, 11 cases (13.3%) recurred after CR, including 4 EC patients and 7 CEH patients. The time to recurrence was 9-46 months after CR, with a median of 20.2 months. Among the 11 recurrence cases, 7 patients underwent surgery, and the remaining 4 patients underwent conserva-

tive treatment again after fully understanding its risk, all of which achieved CR. The recurrence after CR had no statistically significant difference among patients receiving different therapeutic regimens ( $p=0.663$ ). According to the results of univariate and multivariate regression analysis, BMI  $\geq 30$  kg/m<sup>2</sup> and no pregnancy after CR were independent risk factors for recurrence after remission (Table 4).

#### Pregnancy after CR

A total of 76 out of 83 CR patients had the desire for pregnancy, and the pregnancy was successful in 46 patients (60.5%), including 34 patients using ART, 25 (73.5%) of whom had successful pregnancy. Forty-nine patients had natural pregnancy or orally took ovulation-stimulating drugs, and 21 cases (42.9%) had successful pregnancy. The results of univariate and multivariate analysis

**Table 3.** Univariate analysis of predictors for complete response after treatment in the studied patients

Predictors	Complete response (n=83) n (%)	Not complete response (n=13) n (%)	p value
Age, years			0.120
>35	21 (25.3)	6 (46.2)	
$\leq 35$	62 (74.7)	7 (53.8)	
BMI (kg/m <sup>2</sup> )			0.001
$\geq 30$	25 (30.1)	10 (76.9)	
<30	58 (69.9)	3 (23.1)	
Pathological type			0.067
CEH	54 (65.1)	5 (38.5)	
EC	29 (34.9)	8 (61.5)	
Irregular menstruation			0.185
Yes	70 (84.3)	9 (69.2)	
No	13 (15.7)	4 (30.8)	
PCOS			0.833
Yes	28 (33.7)	4 (30.8)	
No	55 (66.3)	9 (69.2)	
Infertility			0.547
Yes	26 (31.3)	3 (23.1)	
No	57 (68.7)	10 (76.9)	
Insulin resistance			0.117
Yes	25 (30.1)	7 (53.8)	
No	58 (69.9)	6 (46.2)	
Treatment			0.184
LNG-IUS	30 (36.2)	2 (15.4)	
MA	28 (33.7)	4 (30.8)	
LNG-IUS + MA	25 (30.1)	7 (53.8)	
Family history of cancer			0.092
Yes	15 (18.1)	5 (38.5)	
No	68 (81.9)	8 (61.5)	

BMI: Body Mass Index; EC: Endometrial carcinoma; CEH: Complex endometrial hyperplasia; PCOS: Polycystic ovary syndrome; LNG-IUS: Levonorgestrel-releasing intrauterine system; MA: Megestrol acetate

showed that BMI  $\geq 30$  kg/m<sup>2</sup> and no ART applied were independent risk factors for successful pregnancy after remission (Table 5).

*Fertility after pregnancy*

Among the 46 patients who had successful pregnancy, fertility was successful in 30 cases (65.2%), including 21 (84.0%) out of 25 cases using ART, and 9 (42.9%) out of 21 cases who had natural pregnancy or ovulation-stimulating pregnancy. The results of univariate and multivariate analysis revealed that ART applied was a protective

factor to improve the live birth rate. It was recommended that the patients whose natural pregnancy was constantly failed be treated in the Department of Reproductive Medicine promptly, and the ART be adopted if necessary. ART can significantly enhance not only the pregnancy rate after remission but also the live birth rate (Table 6).

*Adverse reactions*

No obvious adverse reactions were found in LNG-IUS group. In MA group, there were 4 cases of mild liver dysfunction, 5 cases of significant weight

**Table 4.** Multivariate analysis of predictors for recurrence after complete response in the studied patients

Predictors	Recurrence (n=11) n (%)	Not Recurrence (n=72) n (%)	p value
Age, years			0.099
>35	5 (45.5)	16 (22.2)	
≤35	6 (54.5)	56 (77.8)	
BMI (kg/m <sup>2</sup> )			0.001
≥30	8 (72.7)	17 (23.6)	
<30	3 (27.3)	55 (76.4)	
Pathological type			0.915
CEH	7 (63.6)	47 (65.3)	
EC	4 (36.4)	25 (34.7)	
Irregular menstruation			0.805
Yes	9 (81.8)	61 (84.7)	
No	2 (18.2)	11 (15.3)	
PCOS			0.241
Yes	2 (18.2)	26 (36.1)	
No	9 (81.8)	46 (63.9)	
Infertility			0.278
Yes	5 (45.5)	21 (29.2)	
No	6 (54.5)	51 (70.8)	
Insulin resistance			0.825
Yes	3 (27.3)	22 (30.6)	
No	8 (72.7)	50 (69.4)	
Treatment			0.662
LNG-IUS	3 (27.3)	27 (37.5)	
MA	5 (45.4)	23 (31.9)	
LNG-IUS + MA	3 (27.3)	22 (30.6)	
Family history of cancer			0.110
Yes	4 (36.4)	11 (15.3)	
No	7 (63.6)	61 (84.7)	
Time to CR (months)			0.825
>6	3 (27.3)	22 (30.6)	
≤6	8 (72.7)	50 (69.4)	
Pregnancy after CR			0.009
Yes	2 (18.2)	44 (61.1)	
No	9 (81.8)	28 (38.9)	

BMI: Body Mass Index; EC: Endometrial carcinoma; CEH: Complex endometrial hyperplasia; PCOS: Polycystic ovary syndrome; LNG-IUS: Levonorgestrel-releasing intrauterine system; MA: Megesterole acetate

gain and 1 case of lower limb vein thrombosis. In LNG-IUS + MA group, there were 3 cases of mild liver dysfunction and 6 cases of significant weight gain. No severe cardiovascular complications were caused in the three groups, and both MA and LNG-IUS had higher safety in the conservative treatment of CEH or EC.

## Discussion

EC patients of childbearing age have a strong desire to preserve the organ and fertility during

the cancer treatment. After clinical exploration and practice for more than half a century, the fertility-preserved treatment for early EC has developed rapidly with constant controversy and breakthroughs. It has been confirmed that the fertility-preserved treatment with high-dose high-efficient progesterone is an effective therapeutic regimen for young EC patients, and the commonly-used regimen is the oral administration of high-efficient progesterone, in which medroxyprogesterone acetate or MA is the most frequently used. It has been reported that both of them achieve better therapeutic effects, but

**Table 5.** Univariate and multivariate analysis of predictors for pregnancy after complete response in the studied patients

Predictors	Pregnancy (n=46) n (%)	Not Pregnancy (n=37) n (%)	p value
Age, years			0.489
>35	13 (28.3)	8 (21.6)	
≤35	33 (71.7)	29 (78.4)	
BMI (kg/m <sup>2</sup> )			0.036
≥30	9 (19.6)	15 (40.5)	
<30	37 (80.4)	22 (59.5)	
Pathological type			0.175
CEH	27 (58.7)	27 (73.0)	
EC	19 (41.3)	10 (27.0)	
Irregular menstruation			0.180
Yes	41 (89.1)	29 (78.4)	
No	5 (10.9)	8 (21.6)	
PCOS			0.478
Yes	14 (30.4)	14 (37.8)	
No	32 (69.6)	23 (62.2)	
Infertility			0.449
Yes	16 (34.8)	10 (27.0)	
No	30 (65.2)	27 (73.0)	
Insulin resistance			0.944
Yes	14 (30.4)	11 (29.7)	
No	32 (69.6)	26 (70.3)	
Treatment			0.482
LNG-IUS	14 (32.6)	16 (40.5)	
MA	17 (32.6)	11 (35.2)	
LNG-IUS + MA	15 (34.8)	10 (24.3)	
Family history of cancer			0.451
Yes	7 (15.2)	8 (21.6)	
No	39 (84.8)	29 (78.4)	
Time to CR (months)			0.681
>6	13 (28.3)	12 (32.4)	
≤6	33 (71.7)	25 (67.6)	
ART			0.006
Yes	25 (54.3)	9 (24.3)	
No	21 (45.7)	28 (75.7)	

BMI: Body Mass Index; EC: Endometrial carcinoma; CEH: Complex endometrial hyperplasia; PCOS: Polycystic ovary syndrome; LNG-IUS: Levonorgestrel-releasing intrauterine system; MA: Megesterole acetate; ART: Assisted reproductive technology

how to make progesterone treatment more effective and safer is the focus of further research for clinicians [10,11].

In the present study, the CR rate after treatment was 86.5%, higher than that after simple oral administration of high-efficient progesterone reported by Park et al [10] and Gunderson et al [11], and the possible reason is that patients in this study underwent hysteroscopic surgery to reduce the lesion load before oral administration of progesterone. Gressel et al [12] reported that anovulation, obesity, polycystic ovary syndrome,

metabolic syndrome, insulin resistance and type 2 diabetes mellitus are all risk factors for CEH or EC, and handling the high-risk factors during conservative treatment for such patients is helpful to improve prognosis. In this study, there were 32 patients complicated with polycystic ovary syndrome, and the CR rate and pregnancy rate were 87.5% and 50.0% (28 patients with polycystic ovary syndrome had CR, and they all had the desire for pregnancy, 14 of whom had successful pregnancy), respectively, all significantly higher than the results of previous studies, which may be related to

**Table 6.** Univariate and multivariate analysis of predictors for live birth rate after pregnancy in the studied patients

Predictors	Give birth to neonate (n=30) n (%)	Not give birth to neonate (n=16) n (%)	p value
Age, years			0.167
>35	6 (20.0)	7 (43.8)	
≤35	24 (80.0)	9 (56.2)	
BMI (kg/m <sup>2</sup> )			0.698
≥30	5 (16.7)	4 (25.0)	
<30	25 (83.3)	12 (75.0)	
Pathological type			0.762
CEH	17 (56.7)	10 (62.5)	
EC	13 (43.3)	6 (37.5)	
Irregular menstruation			0.645
Yes	26 (86.7)	15 (93.8)	
No	4 (13.3)	1 (6.2)	
PCOS			0.189
Yes	7 (23.3)	7 (43.8)	
No	23 (76.7)	9 (56.2)	
Infertility			0.517
Yes	9 (30.0)	7 (43.8)	
No	21 (70.0)	9 (56.2)	
Insulin resistance			0.512
Yes	8 (26.7)	6 (37.5)	
No	22 (73.3)	10 (62.5)	
Treatment			0.389
LNG-IUS	9 (30.0)	5 (31.2)	
MA	13 (43.3)	4 (25.0)	
LNG-IUS + MA	8 (26.7)	7 (43.8)	
Family history of cancer			0.626
Yes	4 (13.3)	3 (18.8)	
No	26 (86.7)	13 (81.2)	
Time to CR (months)			0.742
>6	8 (26.7)	5 (31.2)	
≤6	22 (73.3)	11 (68.8)	
ART			0.004
Yes	21 (70.0)	4 (25.0)	
No	9 (30.0)	12 (75.0)	

BMI: Body Mass Index; EC: Endometrial carcinoma; CEH: Complex endometrial hyperplasia; PCOS: Polycystic ovary syndrome; LNG-IUS: Levonorgestrel-releasing intrauterine system; MA: Megesterole acetate; ART: Assisted reproductive technology

the application of metformin for patients with polycystic ovary syndrome during conservative treatment in this study [13,14]. Metformin can enhance the body's insulin sensitivity, reduce the BMI, restore the normal level of androgen, and reduce the source of exogenous estrogen. It has been found in the *in vitro* studies that metformin can increase the expression of progesterone receptor, thereby increasing the body's sensitivity to progesterone, and exerting an anti-tumor effect [15]. Therefore, polycystic ovary syndrome should be treated in patients during conservative treatment, so as to obtain satisfactory prognosis.

In this study, the recurrence rates in obesity patients and non-pregnant patients after CR were 32.0% and 24.3%, respectively, while those in non-obesity patients and pregnant patients after CR were 5.2% and 4.3%, respectively, the former of which were significantly higher than the latter. In foreign countries, Park et al [16] also reported that the recurrence rate in obesity patients is obviously higher than that in non-obesity patients. In addition, there are reports that obesity is also an independent risk factor for the pregnancy outcome, and the pregnancy rate of obesity patients is significantly lower than that of non-obesity patients, consistent with the results in this study [17]. Therefore, it is suggested that the body weight of patients complicated with obesity be strictly controlled and they be closely followed up, and the patients with the desire for pregnancy are encouraged, so that the recurrence rate can be effectively lowered. In theory, the pregnant patients after remission are in a state of high progesterone, which

inhibits the proliferation of tumor cells and exerts an anti-tumor effect, thereby reducing the recurrence rate [18]. In this study, it was also found that ART applied after CR could obviously improve the pregnancy rate, and studies have shown that ART does not increase the risk of recurrence or affect the tumor-free survival rate [19,20]. Therefore, ART can not only evidently raise the pregnancy rate, but also evidently improve the live birth rate in CEH or EC patients. If the patients cannot get pregnant for a long time after CR, they should be treated in the Department of Reproductive Medicine in time to find out the cause of infertility and receive ART if necessary. In this study, no severe complications occurred in patients, mild liver dysfunction and weight gain dominated which were improved after symptomatic treatment. It can be seen that progesterone or LNG-IUS has higher safety in the fertility-preserved treatment for CEH and EC patients.

## Conclusions

To sum up, hysteroscopic surgery combined with LNG-IUS and/or progesterone can achieve satisfactory efficacy for patients who have a strong desire for pregnancy or refuse to remove the uterus. Taking the influencing factors for prognosis into account can further improve the clinical efficacy.

## Conflict of interests

The authors declare no conflict of interests.

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