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Bipolar electrocoagulation *versus* suturing in laparoscopic endometriotic cystectomy: a randomized clinical trial

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ABSTRACT

Objective. The aim of this study was to assess the impact of bipolar electrocoagulation compared to suturing on ovarian reserve during endometriotic cystectomy.

Materials and Methods. A single centre prospective randomized clinical trial was conducted in a university hospital during the period from September 2023 till May 2024. Forty-eight women with unilateral endometriotic ovarian cysts undergoing laparoscopic cystectomy were randomly assigned to one of two haemostasis techniques following the stripping of the cyst wall: bipolar electrocoagulation or intracorporeal suturing.

Results. In both groups, postoperative Anti-Müllerian hormone levels were lower than preoperative levels ($p \leq 0.001$). The mean AMH decline ratio of was significantly greater in the bipolar electrocoagulation than in the suturing group 26.39 ± 12.67 and 15.68 ± 9.53 respectively. Neither the number of sutures nor the number of coagulation pulses was associated with AMH decline ratio (P-values = 0.337 and 0.963). Although the AMH ratio declined more significantly in the bipolar electrocoagulation group, a higher number of women in this group were able to achieve pregnancy post-surgery compared to the suturing group ($p = 0.0395$; 95%CI 3.19% to 69.47%).

Conclusions. Laparoscopic cystectomy for endometrioma is complicated by reduced ovarian reserve, irrespective of the haemostasis technique used. After laparoscopic stripping of endometrioma, intracorporeal suturing is associated with less detrimental impact on ovarian reserve compared to bipolar electrocoagulation.

INTRODUCTION

Laparoscopic cystectomy is the preferred standard treatment option for managing endometriomas. It is favoured by gynaecologic surgeons due to its association with lower recurrence rates and higher rates of spontaneous conception [1].

The primary concern following laparoscopic cystectomy, especially for infertile women with primary reproductive issues, is the reduction in ovarian reserve. This reduction is mainly due to stripping and haemostatic measures [2]. Therefore, meticulous surgical dissection and the selection of appropriate haemostatic measures are needed to

avoid ovarian tissue damage and to maintain the ovarian reserve [3].

Bipolar electrocoagulation (BE) is an easy and simple method that does not demand specialized surgical proficiency; however, it can be associated with thermal damage to the normal ovarian tissue due to the large zones of destruction caused by the high-frequency coagulation [4]. Although, suturing can effectively control bleeding without causing thermal damage, it can produce healthy tissue damage by increasing the intra-ovarian pressure followed by ischemic damage [5].

The existing literature presents conflicting evidence regarding the impact of the type of haemostatic methods on ovarian reserve reduction during laparoscopic cystectomy for endometrioma. Certain studies indicate that laparoscopic cystectomy for endometrioma decreased the ovarian reserve irrespective of the haemostatic techniques used [5-7], whereas others report a significant decline in ovarian reserve with the use of bipolar electrocoagulation (BE) compared to suturing [2,8].

Further investigation is warranted to assess the impact of voltage levels used during BE, the number of cauterized points and coagulation duration to each point, as well as the number of sutures performed during laparoscopic cystectomy for endometrioma on the ovarian function [6].

The aim of this study was to evaluate the impact of bipolar electrocoagulation and suturing during laparoscopic ovarian cystectomy of endometriomas on ovarian reserve.

MATERIALS AND METHODS

This prospective randomized comparative clinical trial was conducted in a university hospital during the period from September 2023 to May 2024. Forty-eight women aged 18 to 35 years with unilateral endometriotic ovarian cyst who underwent laparoscopic ovarian cystectomy were included in the study. We excluded women with anovulatory disorders, decreased ovarian reserve, or premature ovarian insufficiency. Additionally, those who had received hormonal contraceptives or gonadotropin-releasing hormone within three months prior to surgery, individuals with contraindications to laparoscopic procedures, those with a history of previous ovarian surgeries, and those with an ultrasound or tumour markers levels suggestive of potential ovarian malignancy were also excluded from the study.

All participants were subjected to full detailed history taking, examination, and ultrasound evaluation by Samsung WS80 elite ultrasound; EA2-11B vaginal probe for endometrioma size and laterality, and antral follicular count (AFC) on the third day of menstrual cycle. Pre-operative laboratory evaluation included anti mullerian hormone (AMH) and follicle stimulating hormone (FSH) on the second day of menstrual cycle by Roche automated serum technique by Cobas e411 kits by Hitachi. Complete blood count, liver function and renal function tests, coagulation profile were performed as well. Women were assigned randomly to either the bipolar coagulation or suturing group through computer-generated randomization employing a 1:1 allocation ratio. Randomization cards, prepared by an independent statistician and concealed in sequentially numbered opaque wrappers, ensured blinding of the study investigators to group allocation.

Laparoscopic cystectomy was conducted according to the standard operating procedures by highly skilled and experienced endoscopic personnel by performing an incision over the ovarian cyst wall through the cortex, applying meticulous sharp and blunt dissection separating the cyst wall from the ovarian cortex. The adnexal anatomy and the presence of adhesions, depth of ovarian involvement, and *Cul de sac* involvement were evaluated.

In case of significant bleeding following cyst wall stripping, in the BE group the inner stroma was coagulated using lowest possible power setting in coagulation mode (30-Watt current) in conventional BE that is widely used in laparoscopic gynaecology [9] applied to only needed points required to control significant bleeding, as coagulation can extend to a thickness of around 3-4 mm [10]. The number of coagulated points and duration of coagulation at each point were recorded. In laparoscopic suturing group sutures in the ovarian parenchyma to control significant bleeding points were performed with intracorporeal knots using 2-0 polyglactin absorbable sutures.

Data regarding the number of coagulation pulses, number of sutures needed to control the bleeding, and the duration of the procedure was obtained. Post-operative pain was evaluated at 1hr, 3hr, 6hrs, 12hrs and 24 hours using visual analogue scale (VAS) and the physician satisfaction was recorded using a 3 points Likert scale (highly satisfied, fairly satisfied and not satisfied).

Women were evaluated for ovarian reserve by measuring FSH and the antral follicular count on

the third day of the third postoperative menstrual cycle. Anti-Mullerian hormone was also measured 6 weeks after the procedure.

All hormonal measurements were performed in the same reference laboratory. The decline ratio of serum AMH levels was calculated as the value of $(\text{preoperative AMH levels} - \text{postoperative AMH levels}) / \text{preoperative AMH levels}$, and the increase ratio of FSH levels was calculated as the value of $(\text{post-operative FSH levels} - \text{preoperative FSH levels}) / \text{post-operative FSH levels}$.

The primary outcome was ovarian reserve at 6 weeks, assessed by AMH, AFC, and FSH on the third postoperative menstrual cycle.

Statistical methods

Sample size

Using PASS 15 program for sample size calculation, setting alpha error at 0.05 and according to Asagri *et al.* [2], the expected decline rate of AMH levels in bipolar coagulation group = 53.42+15.28 and in suturing group = 15.94+18.55. Sample size of 20 women per group were needed to detect the difference between two groups with power > 90%. 20% was added to each group for the risk of attrition and dropout rate, thus making each group 24 patients.

Statistical analysis

Analysis was performed using SPSS for windows v 20.0. Data was presented in terms of mean and standard deviation (for numeric parametric variables), median and inter-quartile range (for numeric non-parametric variables), or number and percentage (for categorical variables). Difference between two independent groups was analysed using independent student's t-test (for numeric parametric variables), or chi-squared test (for categorical variables).

Repeated measure analysis of variance (ANOVA), including Pillai's Trace, and Wilks'

Lambda was used to analyse repeated measures of AMH, AFC and FSH over time. Linear logistic regression analysis was used to examine the relation between haemostatic measure and AMH decline ratio after adjustment for the effect of potential confounders.

RESULTS

During the study period between the period from September 2023 to April 2024, 65 patients were

assessed for eligibility. In accordance with the inclusion criteria, ten women were excluded from the study: three had a history of ovarian cystectomies, two were diagnosed with polycystic ovarian disease, two were using hormonal contraceptives, and three presented with acute abdomen due to ovarian torsion or a ruptured cyst. Additionally, seven women declined to participate in the study. Consequently, the final analysis included data from 43 women, as five participants were lost to follow-up. The recruitment process and management of the study population throughout the study are illustrated in the flow diagram, conforming to the CONSORT guidelines (**Figure 1**).

There was no statistically significant difference between the two groups regarding the baseline demographic and clinical characteristics. Chronic pelvic pain was significantly more common in BE group, P-value = 0.045 (**Table 1**).

The median preoperative AMH level in the suturing group was 3.60 (2.74-4.05) while it was 3.50 in the coagulation group with IQR (2.70-4.00).

Intraoperatively, there was no statistically significant difference between both groups regarding the extent of ovarian involvement, AFS adnexal adhesion score, and the extent of *Cul de sac* involvement, while the operative time was significantly longer in the suturing group with P-value = 0.041 (**Table 2**).

Regarding the measured post-operative outcomes, there were no statistically significant differences between the two groups in terms of pain scores, as evaluated by the Visual Analog Scale at various assessment points, nor in surgeon satisfaction with the procedure. However, the rate of decline in AMH levels and the rate of increase in FSH levels differed significantly between the groups, with P-values of 0.003 and 0.001, respectively (**Table 3**). The reproductive outcomes varied significantly between the two groups. Among the 12 women in the suturing group who sought fertility postoperatively, 2 women achieved spontaneous pregnancy, and 2 experienced failed *in vitro* fertilization attempts. While, in the coagulation group, out of the 10 women who pursued pregnancy, 4 women achieved spontaneous pregnancy, and 2 succeeded through assisted reproduction (P-value = 0.0395; 95%CI 3.19 to 69.47).

Repeated measure analysis of variance for comparing different measures of ovarian reserve over time, there was a significant change in all measured variables (AMH, FSH, and AFC) over time

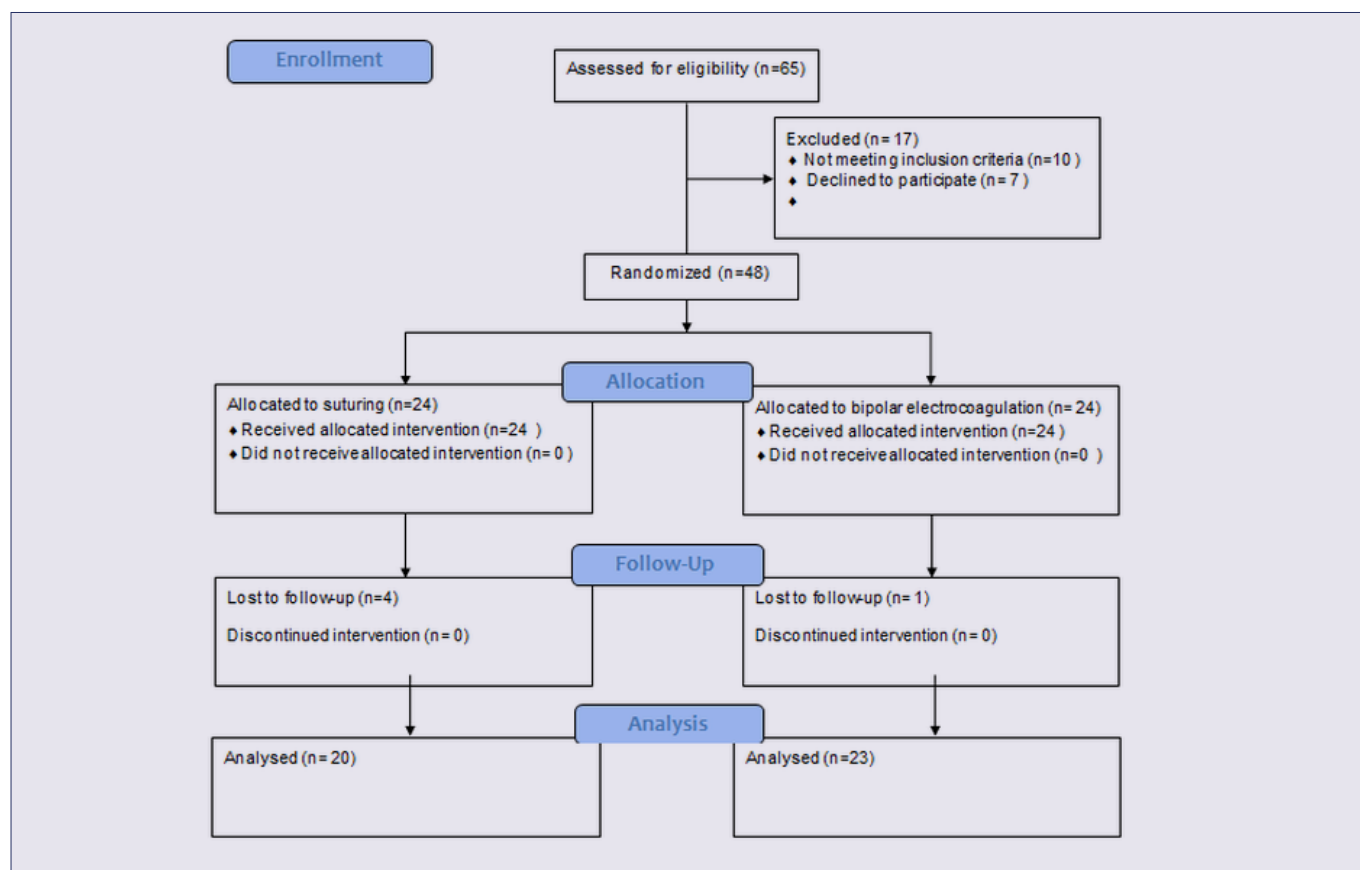


Figure 1. CONSORT participants flow through the trial.

Table 1. Basic demographic and clinical characteristics in the two study groups.

Suturing group	Bipolar electrocoagulation group	P-value	95% Confidence Interval	
Age	27.15 ± 4.40	26.04 ± 5.10	0.454	-1.85 to 0.07
BMI	26.39 ± 4.48	26.33 ± 3.93	0.96	-2.523 to 2.66
Parity			0.514	-17.71 to 35.58
Nulligravida	12 (60.0%)	16 (69.6%)		
Parous	8 (40.0%)	7 (30.4%)		
Previous abortions	3 (15.0%)	3 (13.0%)	0.853	-19.43 to 24.69
Previous caesarean section	6 (30.0%)	5 (21.7%)	0.503	-16.36 to 33.88
Dysmenorrhea	7 (35.0%)	7 (30.4%)	0.751	-21.90 to 30.89
Chronic pelvic pain	12 (60.0%)	20 (87.0%)	0.045	0.69 to 49.97
Infertility	9 (45.0%)	8 (34.8%)	0.500	-17.75 to 36.42
endometrioma longitudinal diameter (cm)	6.14 ± 1.57	6.58 ± 1.68	0.384	-1.44 to 0.57
endometrioma transverse diameter (cm)	4.81 ± 1.30	4.55 ± 1.34	0.528	-0.56 to 1.07
Pre-operative AFC (median (IQR))	15.0 (14.0-15.7)	15.0 (14.0-16.0)	0.734	0.719 to 0.736
Pre-operative AMH	3.33 ± 0.89	3.36 ± 1.00	0.894	-0.63 to 0.55
Pre-operative FSH	9.06 ± 2.02	8.74 ± 2.07	0.613	-0.94 to 1.58

with a significant difference between both groups (Figure 2).

The linear regression analysis indicated that AMH decline ratio was significantly related to the haemostatic method, BMI, ovarian involvement, and preoperative AMH (P-values of < 0.001, 0.029, 0.030

and 0.001, respectively) after adjustment for age, body mass index (BMI), endometrioma diameters, adhesion grading and extent of ovarian involvement (Table 4).

After adjustment for possible cofounding factors, no significant association was found between the

Table 2. Intraoperative findings and interventions in the two study groups.

	Suturing group	Bipolar electrocoagulation group	P-value	95% Confidence Interval
Ovarian involvement			0.127	-5.90 to 46.46
Superficial	15 (75.0%)	12 (52.2%)		
Deep	5 (25.0%)	11 (47.8%)		
AFS adhesions score			0.111	/
Minimal	6 (30.0%)	4 (17.4%)		
Mild	8 (40.0%)	12 (52.2%)		
Moderate	6 (30.0%)	3 (13.0%)		
Severe	0 (0.0%)	4 (17.4%)		
Cul de sac involvement	3 (15.0%)	4 (17.4%)	0.832	-21.08 to 24.43
Number of sutures median (IQR)	4.0 (4.0-5.0)	/	/	/
Number of coagulation pulses median (IQR)	/	6.0 (5.0-7.0)	/	/
Operative duration (minutes)	52.45 ± 8.64	47.04 ± 8.15	0.041	0.23 to 10.58

Table 3. Post-operative clinical and laboratory findings and reproductive outcome in the two study groups.

	Suturing group	Bipolar electrocoagulation group	P-value	95% Confidence Interval
Post-operative pain score after 1hr	0.85 ± 0.67	1.00 ± 0.60	0.444	-0.54 to 0.24
Post-operative pain score after 3hr	1.75 ± 0.79	2.09 ± 0.67	0.136	-0.78 to 0.11
Post-operative pain score after 6hr	2.70 ± 0.80	2.96 ± 0.64	0.250	-0.70 to 0.19
Post-operative pain score after 12 hr	2.45 ± 0.94	2.57 ± 0.99	0.700	-0.71 to 0.48
Post-operative pain score after 24 hr	1.10 ± 0.72	1.09 ± 0.60	0.948	-0.39 to 0.42
Timing till mobilization	3.31 ± 0.34	3.19 ± 0.33	0.255	-0.09 to 0.33
Surgeon satisfaction with the procedure	0.193	/		
Highly satisfied	4 (20.0%)	10 (43.5%)		
Fairly satisfied	12 (60.0%)	8 (34.8%)		
Not satisfied	4 (20.0%)	5 (21.7%)		
Post-operative AFC	14.0(14.0-15.0)	13.0(12.0-14.0)	0.004*	0.002 to 0.005
Post-operative AMH	2.86 ± 0.94	2.57 ± 0.99	0.333	-0.31 to 0.89
Post-operative decline ratio of AMH (%)	15.68 ± 9.53	26.39 ± 12.67	0.003*	-17.45 to -4.48
Post-operative FSH	10.81 ± 2.15	11.25 ± 2.06	0.491	-1.74 to 0.85
Post-operative increase ratio of FSH (%)	16.50 ± 4.49	22.98 ± 6.07	0.001*	-9.72 to -3.37

*Statistically significant.

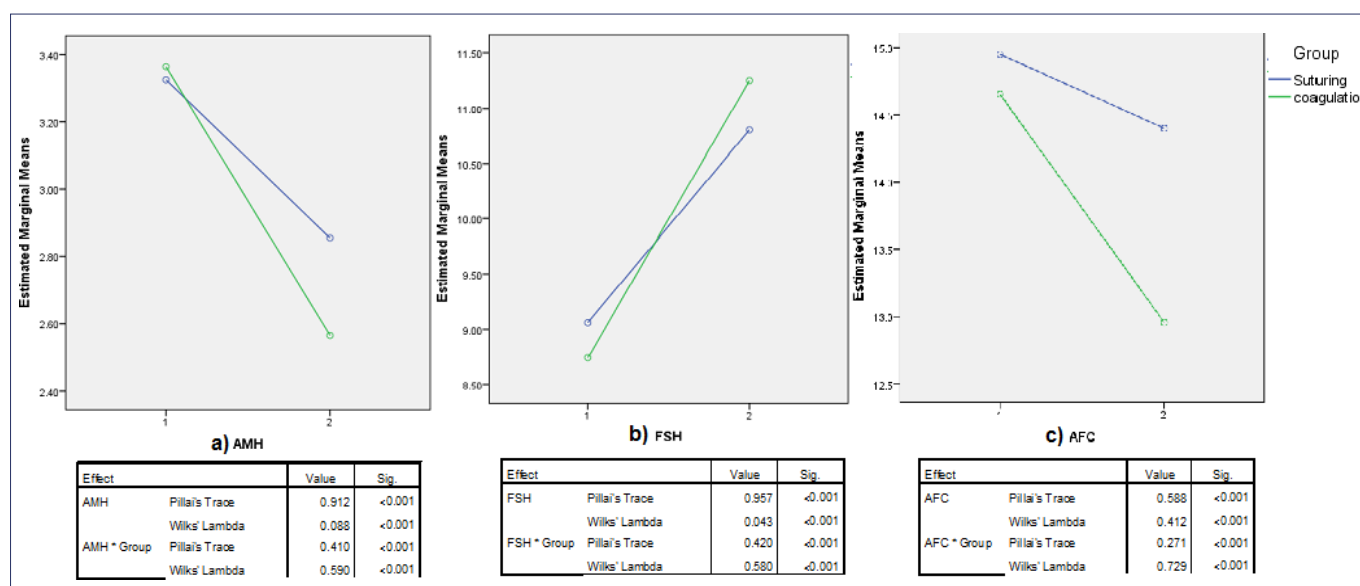


Figure 2. Repeated measure analysis accounts for within subject variability, to assess changes in ovarian reserve over time.

Table 4. Linear regression analysis for the effect of hemostatic method on AMH decline ratio.

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	12.246	17.382		0.704	0.486
Age	-0.248	0.283	-0.095	-0.875	0.388
BMI	0.785	0.344	0.262	2.284	0.029
Endometrioma longitudinal diameter	-2.037	1.224	-0.266	-1.664	0.105
Endometrioma transverse diameter	3.341	1.825	0.353	1.831	0.076
Ovarian involvement	-6.744	2.979	-0.265	-2.264	0.030
Adhesion grading	-0.230	1.589	-0.017	-0.145	0.886
Preoperative AMH	-5.873	1.571	-0.445	-3.737	0.001
Hemostatic method	14.079	2.706	0.572	5.203	0.000

Table 5. Linear regression analysis for the effect of number of coagulation pulses and sutures on AMH decline ratio.

Group	Suturing group					Bipolar electrocoagulation group				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta			B	Std. Error	Beta		
Constant	31.896	23.809		1.340	0.207	17.60	19.038		0.925	0.371
Age	-0.238	0.412	-0.110	-0.578	0.575	-0.14	0.366	-0.060	-0.406	0.691
BMI	0.592	0.492	0.279	1.203	0.254	1.195	0.451	0.371	2.653	0.019
Endometrioma longitudinal diameter	0.607	2.394	0.100	0.254	0.804	7.107	2.181	0.753	3.258	0.006
Endometrioma transverse diameter	-5.265	3.505	-0.716	-1.502	0.161	-2.69	2.089	-0.356	-1.290	0.218
Ovarian involvement	5.763	6.672	0.269	0.864	0.406	-7.39	3.204	-0.298	-2.307	0.037
Adhesion grading	0.225	2.794	0.019	0.080	0.937	-2.95	1.780	-0.227	-1.660	0.119
Number of sutures	2.046	2.036	0.216	1.005	0.337					
Coagulation pulses						0.081	1.706	-0.010	-0.047	0.963
Preoperative AMH	-5.966	2.290	-0.560	-2.605	0.024	5.39	1.818	-0.426	-2.967	0.010

number of sutures or the number of pulses and the decline ratio of AMH (P-values = 0.337 and 0.963) (Table 5).

In the suturing group, the only independent predictor of the decline in AMH was the preoperative AMH level ($p = 0.024$). On the other hand, BMI, longitudinal endometrioma diameter, ovarian involvement, and preoperative AMH were identified as independent predictors of AMH decline within the coagulation group ($p = 0.019, 0.006, 0.037$ and 0.010 respectively).

DISCUSSION

Endometriosis is a major debilitating gynaecological disease usually presents by infertility; chronic

pelvic pain that affects 10% of reproductive aged women globally [11].

The current study found that applying suturing or BE to control bleeding during laparoscopic cystectomy for endometrioma was associated with a reduction in ovarian reserve. There was a significant change in AMH, FSH, and AFC after surgery with a significant difference existed between both groups. The mean AMH decline ratio was 15.68 ± 9.53 in suturing group *versus* 26.39 ± 12.67 in the BE group, while the mean FSH increase ratio was 16.50 ± 4.49 and 22.98 ± 6.07 for suturing and BE groups, respectively.

All surgeries were performed by expert laparoscopic team who were equally satisfied by both procedures. Higher operative time was observed in the suturing group 52.45 ± 8.64 *versus* $47.04 \pm$

8.15 in BE group (P-value = 0.041), due the time spent in intracorporeal suturing as there was no difference between groups regarding adhesions score, ovarian involvement or *Cul de sac* involvement.

The presence of endometrioma is linked to a diminished ovarian reserve, due to fibrosis and the loss of cortex-specific stroma, leading to reduced follicular density. Additionally, surgical excision of endometrioma has been documented to cause significant decline in AMH levels. This decline was correlated to larger cyst sizes and the presence of bilateral lesions [12-14].

Surgical management of endometrioma is associated with reduced ovarian reserve due to accidental removal of healthy ovarian tissue adjacent to capsule as the endometriotic cyst wall is formed by invagination of ovarian cortex. Moreover, the presence of inflammatory process leading to fibrotic adhesions makes it difficult to recognize the cleavage plane between the cyst wall and adjacent ovarian cortex tissue. The extensive adhesiolysis required to complete ovarian cystectomy can compromise the vascular supply of the ovary leading to decreased reserve [15, 16].

This highlights the need to always assess the state of fertility before any surgical intervention [17] and perform oocyte freezing, whenever possible to maintain fertility as in other several fertility sparing surgeries performed in oncologic patient [18].

In the current study, the AMH decline ratio was significantly related to the haemostatic method, BMI, ovarian involvement, and preoperative AMH after adjustment for age, body mass index (BMI), endometrioma diameters, adhesion grading and extent of ovarian involvement.

To date, conflicting findings were reported regarding the influence of haemostatic methods used during laparoscopic cystectomy of endometriomas on ovarian reserve.

Araujo and his colleagues compared the use of bipolar energy, haemostatic sealant, and suturing during laparoscopic cystectomy of unilateral endometriomas. There was no significant difference in AMH levels between the three groups before and up to 6 months following surgery [6].

Another study involved 100 cases with bilateral endometrioma documented that the laparoscopic cystectomy led to diminished ovarian reserve, irrespective of the haemostatic techniques employed. There was no significant difference in the decreased AMH levels between BE and suturing groups at 3-, 6-, and 12-month follow-up [7].

On the contrary, Song *et al.* found that the rate of postoperative AMH decline was significantly higher in BE group than in the suture group (42.2% (IQR 16.5%-53.0%) and 24.6% (IQR 11.6%-37.0%)), respectively [8]. This finding was corroborated by another study, which demonstrated that both ultrasonic scalpel and BE haemostasis were associated with a significant reduction in ovarian reserve compared to suturing [19].

A systematic review and meta-analysis involving ten studies, and analysing the data of 748 women, concluded that using barbed or simple sutures was considered an optimal strategy for mitigating reductions in AMH levels [20].

The extent of ovarian involvement was an independent factor affecting the rate of AMH decline. The deeper involvement resulted in difficult stripping of the endometrioma from the healthy ovarian parenchyma, particularly when the ovarian hilus was approached.

Several studies evaluated different methods to overcome this issue, all showed significant preservation of ovarian reserve after laparoscopic cystectomy. Donnez *et al.*, used a combined technique of cyst stripping followed by CO₂ laser vaporization of the remaining 10%-20% of the endometrioma close to the hilus to avoid removing normal ovarian tissue [21]. The combined (stripping and ablation) technique was associated with comparable ovarian volume and antral follicle count (AFC) between the operated ovary and the contralateral non-operated ovary [21].

Another approach by Candiani and colleagues evaluated the application of a one-step CO₂ laser vaporization targeting the internal cyst wall, subsequent to the drainage of its contents. They reported that CO₂ vaporization caused minimal damage to the healthy ovarian tissue [22].

Furthermore, Tsolakidis and colleagues achieved less AMH decline by applying a three-stage laparoscopic cystectomy that included an initial laparoscopy for cyst drainage, irrigation, inspection, and biopsy. Followed by GnRH agonists administration for three months to reduce cyst size and activity. Followed by a second laparoscopy to vaporize the internal cyst wall and treat any superficial active endometriosis. Reapproximating of the ovarian tissue edges was performed by using a low power density CO₂ laser without sutures [23].

Our participants showed a mean AMH decline ratio of 15.68 ± 9.53 in suturing group *versus* 26.39 ± 12.67 in the coagulation group which exhibit a comparable reduction rate in the suturing group and

significant lower reduction rate in BE group when compared to the findings of Asagri and colleagues [2]. They reported a decline rate of 15.94+18.55 and 53.42+15.28 in suturing and BE groups, respectively. The marked less reduction in AMH in BE group in our study could be explained with the parameters we adopted during the use of BE. Given the hypothesis that the careful and judicious use of coagulation during surgery might mitigate adverse effects on ovarian function, we implemented specific parameters: the voltage was limited to 30 watts, and the duration of coagulation pulses was restricted to less than 3 seconds. Additionally, both suturing and coagulation were performed after gauze packing of the ovarian parenchyma following the stripping of the cyst wall. Therefore, the number of coagulation points and the number of sutures did not affect the AMH decline ratio in the current study. A prior study – which employed the minimal possible amount of bipolar energy (30 W) to ≤ 5 coagulation points with coagulation times ranging from 0.5 to 5 seconds – demonstrated a reduction in ovarian function damage compared to suturing and haemostatic sealants. Six months after surgery, they reported median AMH levels of 1.65, 1.187, and 1.53 ng/mL in coagulation, sealants, and suturing groups, respectively [6].

Mansouri *et al.* reported a significant negative correlation between the number of cauterizations applied and the reduction in serum AMH levels ($p \leq 0.001$). The minimal decrease in AMH levels was observed when only one pulse of coagulation was applied (0.42 ± 0.4 ng/ml), whereas the greatest decline was noted in the group that received more than four coagulation pulses (1.95 ± 0.76 ng/ml) [24].

To accurately reflect the clinical significance of using different haemostatic techniques in laparoscopic cystectomy, pregnancy rates and in vitro fertilization outcomes were evaluated, as these factors constitute the primary concern for most women undergoing endometrioma excision. The present study demonstrated a significantly higher incidence of pregnancy, either spontaneously or through assisted reproduction, in the BE group compared to the suturing group ($p = 0.0395$; 95%CI 3.19% to 69.47%). In contrast, a recent meta-analysis encompassing 14 studies and 1,435 women indicated that overall pregnancy rates were comparable across different haemostatic methods [25]. However, this finding carries the potential for random variation due to the small sample size. The higher incidence of pregnancy in the BE group may be attributed to

the reduced adhesion formation with BE compared to suturing by introducing less foreign bodies and causing less ischemia therefore reducing the extent and severity of adhesions [26, 27].

CONCLUSIONS

This study unequivocally demonstrated that laparoscopic ovarian cystectomy is associated with a reduction in ovarian reserve among women of reproductive age. Furthermore, it was observed that bipolar electrocoagulation results in a greater decrease in ovarian reserve parameters compared to suturing. A major strength of this study is its randomized comparative design. The thorough examination of adhesion severity and the extent of ovarian involvement, along with their influence on serum AMH levels, was conducted, as they are key determinants of diminished ovarian reserve following endometrioma excision. Furthermore, the assessment of suture counts and coagulation pulses, while adopting constraints on voltage and duration to mitigate healthy ovarian tissue damage.

Some limitations in this study are worth highlighting. Firstly, it had a small sample size, however despite the small number of women included in each group; both groups were comparable in terms of age, mean size of endometriomas with no differences in preoperative measured hormones or ultrasound scan findings and all procedures were performed by expert laparoscopic team. Furthermore, ovarian reserve parameters were not evaluated beyond a three-month post-operative period, primarily due to heightened costs, whereas assessing reproductive outcomes would hold greater clinical significance.

The presence of endometrioma even without surgical intervention is linked to diminished ovarian reserve thus evaluation of the reduction of ovarian reserve in untreated patients compared to those undergoing surgical intervention need to be addressed in future studies as the conservative approach is clinically favoured due to the assumption of better fertility outcomes.

COMPLIANCE WITH ETHICAL STANDARDS

Authors' contributions

O.K.: Methodology, formal analysis, writing – review and editing. K.A.: Conceptualization, super-

vision, writing – review and editing. N.A.: Data curation, investigation, writing – review & editing. R.A.: Conceptualization, methodology, supervision, writing – original draft.

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Study registration

The trial was retrospectively registered on clinicaltrials.gov with ClinicalTrials.gov identifier NCT06421857 on 15th May 2024 (<https://clinicaltrials.gov/study/NCT06421857?term=NCT06421857&rank=1>).

Disclosure of interests

The authors declare that they have no conflict of interests.

Ethical approval

The study was approved by the Ethical and Research Committee of the Council of Obstetrics and Gynecology Department, and Faculty of Medicine Ain Shams University Ethical Research Committee (FMASU ERC) (FMASU MS 498/2023) on 29/8/2023.

Informed consent

An informed written consent was obtained from each participant after the study purpose and procedures were explained to them by the principal investigator.

Data sharing

Data are available under reasonable request to the corresponding author.

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