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Different laparoscopic techniques for endometrioma excision and their effect on ovarian reserve

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SUMMARY

AUTHORS' CONTRIBUTION: (A) Study Design · **(B)** Data Collection . **(C)** Statistical Analysis · **(D)** Data Interpretation · **(E)** Manuscript Preparation · **(F)** Literature Search · **(G)** No Fund Collection

Background: Surgery of endometrioma sometimes reduces ovarian reserve.

Methods: We here evaluated the effect of two different laparoscopic techniques on ovarian reserve markers: "complete laparoscopic cystectomy" (n=40) *versus* "partial cystectomy and coagulation of the adherent cyst wall of endometrioma" (n=40). Ovarian reserve was evaluated by measuring serum AMH and Basic AFC on day three of the menstrual cycle (preoperative) and 6-month after the surgery.

Results: Preoperative ovarian reserve was the same between the two groups. Postoperative ovarian reserve reduced similarly in both groups.

Conclusion: Two procedures showed similar reduction of ovarian reserve.

Keywords: Laparoscopy; Endometrioma; Ovarian reserve

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INTRODUCTION

Ovarian endometriosis (endometriomas) is a common gynecological disease that occurs up to 10% of reproductive women and the prevalence of disease is up to 20 to 50% in infertile women [1].

The most effective treatment for endometriotic cyst is controversial. The first-line management of endometriotic cyst, a diameter larger than 3 cm, is a laparoscopic ovarian cystectomy. Moreover, management of endometrioma larger than 3 cm in women who have an infertility problem should consist of ovarian cystectomy prior to assisted reproductive technologies to improve pelvic pain or help perform the oocyte retrieval procedure without difficulties [2].

Although laparoscopic ovarian cystectomy provides the lowest recurrence and the highest chance of spontaneous pregnancy rate, risk of significant ovarian injury can occur. Ovarian injury is thought to be caused by loss of healthy ovarian follicles during surgery and inflammation caused by surgical trauma or vascular injury. Recent data have demonstrated that surgical treatment of endometriotic cyst has an adverse effect on ovarian reserve [3].

Inadvertent removal of normal ovarian tissue is one of the reasons for the reduction in ovarian reserve during cystectomy [3].

Various therapies are available to treat ovarian endometrioma, including expectant care, ultrasound-guided aspiration, and draining of the endometriotic cyst, complete cystectomy, partial stripping of the non-adherent cyst wall and bipolar coagulation of the adherent cyst wall and radical treatment by hysterectomy with salpingoophrectomy [4]. In comparison to draining and coagulating large endometriomas, several studies show that laparoscopically excising large endometriomas increases pregnancy rates and decreases recurrence rates [5].

The phrase "ovarian reserve" refers to a woman's current egg supply and is strongly related to her reproductive potential. Anti-Mullerian hormone (A M H) has been recognized as the most practical, trustworthy, and sensitive hormonal serum marker of the ovarian primordial follicle pool when compared to other established serum indicators [6,7]. Furthermore, early antral follicle count (AFC), as determined by ultrasonography and serum AMH levels has a high correlation. Show that both AFC and AMH definitely contribute value to female age in the prediction of poor ovarian response in IVF in a meta-analysis based on 28 research previously reported [8].

AIM OF THIS WORK

To investigate the effect of two different laparoscopic techniques "complete stripping and partial stripping of cyst wall with bipolar ablation of adherent areas " for management of ovarian endometrioma on ovarian reserve.

Patients and Methods

This study was carried out between 2018 and 2020. Cases included in this study were selected according to the following.

Inclusion criteria:

1. Age ≤ 35 y.
2. Unilateral ovarian endometrioma ≥ 3 cm.
3. BMI = 18 -28.
4. Regular cycle occurring every 24 - 35 day.

Exclusion criteria:

1. Previous ovarian surgery.
2. Ovarian suppressive therapy in the preceding 6 months.
3. Suspected ovarian malignancy.

Intervention:

The study included 80 patients divided into two main groups according to the mode of surgery:

Group I: 40 patients who underwent complete laparoscopic ovarian cystectomy.

Group II: 40 patients who underwent laparoscopic partial ovarian cystectomy with bipolar diathermy of the cyst wall adherent to the ovarian hilum.

All patients included were submitted to the following:

1. Complete history taking.
2. Complete general and abdominal examination.
3. Local pelvic examination.
4. Ovarian reserve assessment: This was done before and 6 months after the procedure by:

a) Serum AMH by (AMH Gen ll ELISA, REF: A79765).

b) Basal AFC on day 3 of menstrual cycle.

5. Operative laparoscopy.

After induction of general anesthesia, a 10mm laparoscope was introduced through the umbilicus, 2 or 3 accessory 5 mm ports were introduced just above pubic hair line, lateral to epigastric vessels for introduction of ancillary instruments. After initial pelvic and abdominal evaluation, the ovary with endometrioma was mobilized and freed of adhesions if any. Once the cyst is mobilized, the cortex is grasped with forceps. Adequate cortical incision using scissors was done in anti-mesenteric surface of the ovary as far as possible from the hilum. Separation of the cyst wall from ovarian stroma was then tried using both blunt and sharp scissor dissections. If the cyst was opened and spillage occurred, aspiration of chocolate fluid and peritoneal irrigation was done. Identification of the correct plane of cleavage between the cyst wall and ovarian tissue was done by applying opposite bimanual traction using 5 mm grasping forceps. Then, the wall of the cyst is stripped from normal ovarian tissue using traction and counter traction by grasping forceps. The bed of the cyst was carefully inspected and any bleeding areas were coagulated with bipolar forceps. If complete stripping was accomplished the patient was categorized into group 1. On the other hand, if complete stripping can't be accomplished due to excessive bleeding or indistinct plane of cleavage,the cystectomy was stopped because of risk of removing normal ovarian tissue along with endometrioma wall, bipolar forceps, is then used to cauterize the remaining adherent residual cyst wall. These patients were then categorized as group 2.

The outcomes evaluated in this trial were:

Postoperative ovarian reserve tests:

Assessed by follow up of patients 6 months later after the operation through measurement of serum AMH and basal AFC by transvaginal ultrasound on day 3 of menstrual cycle.

Statistical analysis: Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0.

RESULTS

Basic characteristics of both groups are shown in **Tab. 1.** No significant differences regarding age, BMI, mean parity and miscarriage rate were recorded between both groups. **Tab. 2.** show the preoperative characteristics of ovarian endometrioma in both groups. No significant differences were reported regarding the size or the site "RT or LT" of endometrioma in both groups. Basic preoperative ovarian reserve tests (AFC and AMH) of both groups are shown in **Tab. 3.** The mean pre-operative serum level of AMH was 3.3 ± 0.8 and 3.2 ± 0.68 ng/ml in group 1 and group 2 respectively. The mean basic AFC were 14.3± 1.75 and 14.2 ± 1.3 follicles in group 1 and group 2 respectively. The pre-operative ovarian reserve tests "AFC and AMH" were comparable in both groups. Postoperative ovarian reserve tests serum (AMH and BAFC) is shown in **Tab. 4.** & **Tab. 5.** months later after the operation. Both groups were also comparable regarding postoperative ovarian reserve tests with non-significant reported differences. The degree of post-operative reduction of both AMH and AFC were non-significantly different between both groups (**Tab. 6.**).

DISCUSSION

There are two main risks associated with the surgical treatment of endometriomas. The risk of excessive surgery with removal or destruction of normal ovarian cortex together with the endometrioma and the risk of incomplete

Tab. 1. Basic characteristics of study groups.

Variables	Group I (n=40)	Group II (n=40)	P
Age (years)			
Range	25 – 35	24 – 34	0.701[1]
Mean ± SD	30.15 ± 2.81	29.8 ± 2.91	NS
BMI (kg/m^2)			
Range	18 – 28	19 – 27	0.139[1]
Mean ± SD	24.7 ± 3.05	23.35 ± 2.58	NS
Parity			
Range	0 – 2	0 – 3	0.531[2]
Median (IQR)	1 (1 – 2)	1 (0 – 2)	NS
No. of Previous Miscarriages			
Range	0 – 2	0 – 3	0.271[2]
Median (IQR)	1 (1 – 2)	1 (0 – 1)	NS

SD standard deviation; IQR interquartile range; BMI body mass index [calculated as weight (g) divided by squared height (m^2)]; [1] Analysis using independent student's t-test; [2] Analysis using Mann-Whitney's U-test; NS non-significant

Tab. 2. Characteristics of endometriomas in study groups.

Variables	Group I (n=40)	Group II (n=40)	P
Maximum Diameter (cm)			
Range	3 – 6	3.3 – 6	0.404[1]
Mean ± SD	4.74 ± 0.93	4.51 ± 0.43	NS
Site			
Right-sided	26 (65%)	22 (55%)	0.519[2]
Left-sided	14 (35%)	18 (45%)	NS

SD standard deviation; Data presented as range, mean ± SD; or number (percentage); [1] Analysis using independent student's t-test; [2] Analysis using Chi-squared Test; NS non-significant

Tab. 3. Preoperative ovarian reserve of endometriomas in study groups.

Preoperative	Group I (n=40)	Group II (n=40)	P
Serum AMH (ng/ml)			
Range	2.2 – 4.6	2.1 – 4.2	0.57[1]
Mean ± SD	3.3 ± 0.8	3.2 ± 0.68	NS
AFC			
Range	12 – 17	12 – 17	0.76[1]
Mean ± SD	14.3 ± 1.75	14.2 ± 1.3	NS

AMH anti-müllerian hormone; AFC antral follicular count; SD standard deviation; Data presented as range, mean ± SD;[1] Analysis using independent student's t-test; NS non-significant

Tab. 4. Postoperative ovarian reserve.

Postoperative	Group I (n=40)	Group II (n=40)	P
Serum AMH (ng/ml)			
Range	1.2 – 2.8	1.1 – 2.6	0.73[1]
Mean ± SD	1.9 ± 0.5	1.8 ± 0.46	NS
AFC			
Range	8 – 13	8– 12	0.34[1]
Mean ± SD	10.2 ± 1.5	9.8± 1.1	NS

AMH anti-müllerian hormone; AFC antral follicular count; SD: standard deviation; Data presented as range, mean ± SD. [1]Analysis using independent student's t-test; NS non-significant

Tab. 5. Pre and- postoperative ovarian reserve tests.

	Preoperative	Postoperative	P
Serum AMH (ng/ml)			
Group I			
Range	2.2 – 4.6	1.2 – 2.8	<0.001
Mean ± SD	3.3 ± 0.8	1.9 ± 0.5	HS
Group II			
Range	2.1 – 4.2	1.1 – 2.6	<0.001
Mean ± SD	3.2 ± 0.68	1.8 ± 0.46	HS
AFC			
Group I			
Range	12 – 17	8 – 13	<0.001
Mean ± SD	14.3 ±1.75	10.2 ± 1.5	HS
Group II			
Range	12 – 17	8– 12	<0.001
Mean ± SD	14.2 ± 1.3	9.8 ± 1.1	HS

AMH anti-müllerian hormone; AFC antral follicle count; SD standard deviation; [1]Analysis using Wilcoxon signed rank Test; [2]Analysis using Paired Student's t-Test; HS highly significant

Tab. 6. Difference between groups regarding reduction in serum AMH & AFC.

Variables	Group I (n=20)	Group II (n=20)	P
Reduction in Serum AMH			
Range	1-1.9	1-2.01	0.237 [1]
Mean ± SD	1.4 ± 0.3	1.6 ± 0.22	NS
Reduction in AFC			
Range	3-6.5	4-5.7	0.171 [1]
Mean ± SD	4.2 ± 0.25	4.4 ± 0.2	NS

AMH anti-müllerian hormone; AFC antral follicle count; SD standard deviation
[1] Analysis using Independent student's t-test; NS non-significant

surgery with subsequent early recurrence of endometrioma [9].

This evident reduction in ovarian reserve and ovarian "life span" has been further explored in several studies. Three main questions arose. The first question was whether the mere presence of endometrioma is the reason for this short- and long-term reduction in ovarian function, The second question was whether the surgical technique for management of endometrioma (excision *versus* deroofing *versus* aspiration) is associated with variable degree of reduction in ovarian reserve, The last question was whether the use of diathermy or suturing affects this reduction in ovarian reserve [10,11].

In the present study, we have reported significant post-operative reduction of both serum AMH levels and AFC (ovarian reserve markers) in both studied groups (group 1 complete stripping *versus* group 2 partial stripping and bipolar coagulation of remaining adherent cyst wall). However, the extent of mean reduction of ovarian reserve markers was comparable in both groups. This means that both studied surgical techniques have comparable, negative impacts on ovarian reserve

Similarly, Celik et al. reported a significant drop of serum AMH at the sixth month (61%) post operatively after laparoscopic endometrioma stripping. The decrease of AMH level was more evident in patients with the cyst <5 cm and in patients with bilateral endometrioma [12].

In their meta-analysis, of the impact of excision of ovarian endometrioma on ovarian reserve, Raffi et al., reported a statistically significant fall (30%) in serum AMH post operatively in patients with unilateral endometrioma. This indicates a significant damage to ovarian reserve following ovarian cystectomy for endometrioma [13].

This was different from ours, as we reported a significant drop of both ovarian reserve markers (AMH and AFC) following ovarian cystectomy of unilateral endometrioma.

In 193 women with endometrioma, Alborzi et al., observed a substantial drop in AMH up to 9 months after laparoscopic cystectomy. They discovered that women with bilateral endometriomas experienced a greater drop in AMH [14]. Surgery may increase the risk of decreased ovarian reserve because healthy ovarian tissue may accidentally be removed together with sick ovarian tissue [15].

Furthermore, the mere presence of endometrioma is associated with a lower cortical follicular density and more fibrosis when compared with contralateral ovaries without cyst. This demonstrates the adverse effects of mere presence of endometriomas on ovarian reserve in these patients [16].

Regard to ours, no significant differences in the degree of decrease of ovarian reserve parameters were reported between both groups. This could be attributed to performance of stripping in both groups. This highlights the risk of stripping, even partial on ovarian reserve.

Increased levels of AFC were also observed by Alborzi et al. three months after surgery. According to both authors and Celik et al. [14] AFC is a less accurate indicator of ovarian reserve when endometrioma is present. Overall, it is debatable whether or not to employ AMH and AFC as ovarian reserve markers before and after surgically treating endometrioma. Muzi et al. disputed the finding that AMH reduces following endometrioma excision in their meta-analysis [15].

Laparoscopic treatment for ovarian endometrioma has been associated with worsening ovarian reserve in a number of different ways. These include surgical-related local inflammation, heat injury from adhering cyst wall or bleeding arteries, and unintentional removal of healthy ovarian cortex [16].

Preoperative serum AMH levels in these two groups of women were significantly lower as compared to an age- and BMI-matched control group of women, according to research by Kim et al., on 102 women with ovarian endometriomas and 48 women with mature cystic teratomas [17].

The pathogenesis underlying the adverse impact of surgical management of ovarian endometrioma has been a matter of research. The most accepted explanation by Matallotakis et al., is the use of electrocoagulation for hemostasis after ovarian cystectomy [18].

In support of this explanation, two studies were published by Ercan et al., and Ercan et al., showed that laparoscopic stripping of ovarian endometriomas with minimal electrocoagulation was not correlated with significant reduction in serum AMH [19,20].

Similarly, Litta et al. reported that ovarian endometriotic cyst stripping without bipolar anticoagulation was not associated with significant reduction in the postoperative serum AMH level [21].

A Canadian prospective comparative study by Song et al., on 125 women with ovarian endometriomas showed that hemostasis by electrocoagulation had more profound effect on reduction of serum AMH levels than hemostasis by suturing did [22].

CONCLUSION

We concluded that both techniques complete laparoscopic cystectomy (stripping) and partial cystectomy with bipolar coagulation of the adherent parts of the cyst wall cause a decrease of ovarian reserve markers in both groups "AMH and AFC" but there is no significant difference between both groups in the degree of reduction.

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