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Ovarian Reserve after Laparoscopic Treatment of Ovarian Endometriomas with Two Techniques: Stripping and Ablation

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Abstract

Ovarian endometriomas are cystic manifestation of ovarian endometriosis and very frequent adnexal masses in women of reproductive age. Operative laparoscopy is considered to be gold standard for treatment of patients with ovarian endometriomas regarding the benefits of such treatment. There are many laparoscopic techniques, but stripping and ablation of endometriomas are the most frequently used.

The Aim: To evaluate the effects of two laparoscopic techniques for treatment of ovarian endometriomas on ovarian reserve.

Materials and Methods: In a prospective randomized study, a hundred patients in reproductive age (20-40 years) with unilateral ovarian endometriomas were operated laparoscopically on University Clinic for gynecology and obstetrics in Skopje in period between 15.3.2012 and 15.3.2015.Randomization was made depending of intraoperative findings. Patients were divided in two groups: group 1 with 50 patients operated with stripping techniques and group 2 with 50 patients operated with ablation. Several markers for ovarian reserve were evaluated before operation, three and six months after laparoscopy: ultrasonographic markers (ovarian volume-OV and antral follicle count-AFC), biochemical markers (follicle stimulating hormone - FSH and estradiol - E2) and markers for ovarian vascularization (pulsatility index - PI and resistance index - RI).

Results: In our study statistical analysis has shown a significant reduction in ovarian volume in both groups three and six months after laparoscopy, but this decrease in OV was higher in the first three months after surgery in group 1 ($p \le 0.01$). There was a significant increase in AFC in both groups three and six months after laparoscopy ($p \le 0.01$), with higher increase in group 2. Statistical analysis has shown a decrease in PI and RI in both groups after surgery, with higher decrease of RI in group 1 postoperatively. Serum levels of FSH significantly decreased after laparoscopy in both groups ($p \le 0.01$), while E2 levels significantly increased in both groups after surgery ($p \le 0.01$).

Conclusions: Ovarian reserve decreases after laparoscopic operation of ovarian endometriomas using both techniques: stripping and ablation. Laparoscopic stripping of endometriomas reduces ovarian reserve more than ablation.

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Introduction

Ovarian endometriomas are cystic manifestation of ovarian endometriosis. They present 35% of benign ovarian cysts with indications for operative treatment. Although their exact prevalence and incidence are not known, they have been reported to be found in 17-44% of women with endometriosis [1-3].

Diagnosis of ovarian endometriomas is made by: anamnesis (pelvic pain, dyspareunia, dysmenorrhoea, infertility), gynaecological examination (palpable adnexal mass), ultra sonographic examination, magnetic resonance imaging - MRI, but definitive diagnosis is made by laparoscopy [4-6].

The recommended treatment for ovarian endometriomas is still a subject of debate. It is unclear whether endometriomas have an impact on IVF outcome. ESHRE guidelines for the treatment of endometriosis indicated that IVF pregnancy rates were lower in women with endometriosis than in those with tubal infertility. A general consensus is that ovarian endometriomas larger than 4cm should be removed, both to reduce pain and to improve spontaneous conception rates. The presence of small endometrioma (diameter of 2-4cm) does not reduce the success of in vitro fertilization (IVF) treatment [7].

The goal of operative treatment of endometriosis is to remove all implants, resect adhesions, relieve pain, reduce the risk of recurrence and postoperative adhesions, and restore the involved organs to a normal anatomic and physiologic condition. Today laparoscopy is gold standard for diagnosis and treatment of endometriosis [8-11]. For laparoscopic treatment of ovarian endometriomas usually two techniques are proposed:

1. Stripping technique consisting of the removal of the endometrioma wall with coagulation with bipolar forceps for haemostasis.

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2. Ablation technique with punction of endometrioma, washing with irrigation fluid, than endocoagulation of the interior wall of the cyst.

There are two main risks associated with the surgical treatment of ovarian endometriomas:

1. The risk of excessive surgery (removal of normal ovarian cortex together with the endometrioma capsule).
2. The risk of incomplete surgery (early recurrence of endometrioma).

Laparoscopic excision of the cyst wall of endometrioma was associated with a decreased rate of recurrence of endometrioma, reduced requirement for further surgery and lower recurrence rates of the symptoms of dysmenorrhoea, dyspareunia, non-menstrual pelvic pain in comparison with patients operated with ablative technique. This technique was also associated with a subsequently increased rate of spontaneous pregnancy in women treated because of infertility. Stripping technique was associated with reduced ovarian volume and diminished ovarian reserve more than ablation technique. Preservation of the vascular blood supply to the ovary is very important for preservation of ovarian volume and antral follicular counts [12,13]. To overcome risks associated with laparoscopic operations for ovarian endometriomas: risk of excessive surgery and risk of incomplete surgery Donnez et al. described a new mixed technique with combination of stripping and ablation for the laparoscopic management of endometriomas [14].

Ovarian reserve represents capacity of the ovary to produce healthy eggs available for maturation and capable for fertilization. There are several tests for evaluation of ovarian reserve: serum levels of follicle-stimulating hormone - FSH and estradiol - E2, serum levels of anti-Mullerian hormone - AMH, ultrasonographic markers (ovarian volume and antral follicle countand markers for ovarian vascularization: resistance index - RI and pulsatility index - PI [15-19].

AFC consists with all antral follicles measuring 2-6mm in longitudinal and transverse cross sections of ovary using transvaginal ultrasound scanning at early follicular phase of the menstrual cycle. For evaluation of vascular changes in ovaries affected by endometriomas transvaginal ultrasound with color flow imaging and blood flow analysis of ovarian artery is used. With transvaginal pulsed and color Doppler mapping of intraovarian vessels is done with measurement of PI and RI [20].

The Purpose of the Study

To evaluate the effects of two laparoscopic techniques for treatment of ovarian endometriomas (stripping technique and ablation with endocoagulation) on ovarian reserve.

For these purpose several markers for ovarian reserve were evaluated:

1. ultrasonographic markers (ovarian volume-OV and antral follicle count-AFC),
2. biochemical markers (follicle stimulating hormone-FSH and estradiol-E2),
3. markers for ovarian vascularization (pulsatility index-PI and resistance index-RI).

Materials and Methods

In prospective randomized study, a hundred patients on reproductive age between 20-40 years with ovarian endometrioma were treated with laparoscopic operation in a tertiary hospital (University Clinic of Gynecology and Obstetrics in Skopje, R. N. Macedonia). This study was approved by local ethics comity and all patients signed informed consensus. The patients were divided in two groups. In the first group (group 1) 50 patients were included which were treated with stripping technique. In the second group (group 2) 50 patients were included and treated with ablation. The selection of operative method was made according the intraoperative findings. When endometrioma was located on the surface of the ovary stripping technique was used. When the boundary between the cyst wall and the ovarian cortex was unclear, with extensive adhesions ablative technique was used. The study was conducted in the period from 15.3.2012 to 15.3.2015. Markers of ovarian reserve were investigated before surgery and three and six months after surgery.

Inclusion criteria were: reproductive age between 20-40 years, unilateral ovarian endometrioma with diameter 3-8cm on ultrasonographic evaluation. Exclusion criteria were: suspicion for ovarian malignancy on ultrasonographic evaluation, history for oral contraceptive pill use or hormonal therapy for the last three cycles, BMI>30kg/м², other endocrine diseases such as thyroid disease, hyperprolactinemia, diabetes mellitus or adrenal disorders and previous ovarian surgery. Ultrasonographic evaluation was made in proliferative phase of menstrual cycle by GE Voluson E-8, with a 7.5MHz vaginalprobe (RIC 5-9-D) and 4-8.5 MHz abdominal probe (RAB 4-8-D) for virgo intacta. Ovarian volume and endometriomas volume were calculated with Prolate-ellipsoid formula [D1xD2xD3x0.5233], where D1, D2 and D3 were maximal longitudinal, antero-posterior and transverse diameters, and result was presented in ml. AFC was calculated as total number of ovarian follicle with diameter smaller than 10mm. Analysis of biochemical markers for ovarian reserve: FSH and E2 was done on day 3 of menstrual cycle before surgery and 3 and 6 months after operation. FSH-Immulite 2000 test was used for evaluation of serum levels of FSH. Immulite 2000 test was used for serum levels of estradiol (E2).

For measurement of intraovarian arterial flow Color Doppler, Power Doppler and Pulse wave Doppler were used with measurement of pulsatility index (PI) and resistance index (RI).

All laparoscopic operations were performed by the first author who had experience performing both techniques.

Statistical analysis

Statistical analysis was done with program Statistics Package for Social Sciences (SPSS) ver.12 for OS Windows. Data were presented as mean value±SD. Statistical significance (for $p<0.05$) as difference between numerical variables before surgery and three and six months after laparoscopic operation was evaluated using Student's t-test. The chi-square test was used to compare categorical variables. Wilcoxon-Mann-Whitney test was used to compare continuous variables.

Results

In total, 100 women were included in the study. They were divided in two groups. Group 1 was presented with 50 patients operated laparoscopically by stripping technique and group 2 with 50 patients operated laparoscopically by ablative technique. Statistical analysis did not found any significant differences for the mean (±SD) age and BMI between two groups. The mean age of the patients in the first group was 30.1±5.3 year, and 31.8±5.5 in the second group, BMI (22.4±2.4) in the group 1 and (23.4±3.7) in the group 2. These results are presented on Table 1.

Variables (X±SD)	Laparoscopic techniques		t	p
	Group 1 (stripping) n=50	Group 2 (ablation) n=50		
Age (years)	30.1±5.3	31.8±5.5	1.58	n.s.
BMI (kg/m²)	22.4±2.4	23.4±3.7	1.67	n.s

Table 1: Distribution of patients from both groups according the age and BMI.

According to symptoms, chronic pelvic pain (dysmenorrhoea, dyspareunia) was presented in 41 patients (82%) in group 1 and 37 patients (74%) in group 2, infertility in 9 patients (18%) in group 1 and 13 patients (26%) in group 2. Endometrioma was located on right side in 18 patients (36%) in group 1 and on the left side in 32 patients (64%). Endometrioma was located on the right side in 29 patients (58%) and on the left side in 21 patients (42%) in group 2.

Statistical analysis did not show any significant difference for OV, endometriomas volume and diameter of endometriomas in both groups before laparoscopy.

Statistical analysis showed a significant reduction in ovarian volume in both groups three and six months after surgery, but decreasing in ovarian volume was significantly bigger in the first three months after surgery in group 1 in comparison with group 2 (Mann-Whitney-U test, Z= -2.389, (p≤0.05). OV in the group 1 showed statistically significant decreasing after 6 months in comparison with group 2 (Mann-Whitney-U test, Z= -2.186, p≤0.05). These results are presented on Table 2.

Mann-Whitney U - тест	OV before LPSC	OV after 3 months	OV after 6 months
Z	-1.206	-2.389	-2.186
p	0.228 (n.s.)	≤0.05	≤0.05

Table 2: Comparison of ovarian volume before operation, 3 and 6 months after operation between both groups.

There was no statistically significant difference in AFC in both groups before LPSC and 3 months after operation. Statistical analysis showed statistically significant increasing in AFC in the second group 6 months after LPSC in comparison with group 1 (Mann-Whitney-U test; Z= -4.500, p≤0.01). These results are presented on Table 3.

Man-Whitney-U test	AFC (before LPSC)	AFC (3 months after LPSC)	AFC (6 months after LPSC)
Z	-0.937	-0.904	-4.500
p	0.349 (n.s.)	0.366 (n.s.)	≤0.01

Table 3: Comparison of AFC between both groups before LPSC, 3 and 6 months after LPSC.

Correlation between age and AFC in the first group operated by stripping technique showed that in age group 20-34 years there was small negative correlation between age and AFC before LPSC and 3 months after LPSC (r= -0.24, p≤0.05) and there was no correlation 6 months after LPSC (r= -0.15, p= n.s.). There was statistically significant negative correlation between age and AFC in age group above 35 years three and six months after LPSC (p≤0.01). These results are presented on Table 4.

Correlation between age and AFC in the second group of patients operated with ablation technique showed that there was no significant correlation before LPSC, 3 and 6 months after LPSC in age group under 35 years. In the age group above 35 years there was small negative correlation before LPSC (r= -0.30, p≤0.05), median negative correlation after 3 months (r= -0.47, p≤0.01), and small negative correlation 6 months after LPSC (r= -0.28, p≤0.05), presented on Table 5.

Age	AFC before LPSC	AFC 3 months after LPSC	AFC 6 months after LPSC
20-34 years	r= -0.22 p≤0.05	r= -0.24 p≤0.05	r= -0.15 p=n.s.
Above 35 years	r= -0.28 p= n. s.	r= -0.46 p≤0.01	r=- 0.40 p≤0.01

Table 4: Correlation between age and AFC in group 1 (stripping).

Age	AFC before LPSC	AFC 3 months after LPSC	AFC 6 months after LPSC
20-34 years	r = 0.09 p= n. s.	r= -0.01 p= n. s.	r= -0.12 p= n. s.
Above 35 years	r= -0.30 p≤0.05	r= -0.47 p≤0.01	r= -0.28 p≤0.05

Table 5: Correlation between age and AFC in group 2 (ablation).

There were no statistically significant differences between both groups for PI and RI before operation and 3 and 6 months after laparoscopy. Also, there was no significant difference for FSH in both groups before operation, 3 and 6 months after laparoscopy (p>0.05).

There was no significant difference for E2 levels between both groups before and 6 months after laparoscopy, and after 3 month there was statistically significant decrease of E2 levels in the group 2 in comparison with group 1 (Mann-Whitney test; Z= -2.169; p≤0.05).

Statistical analysis was made for all variables for each group patients before operation, three and six months after operation and between six and three months after operation.

Statistical analysis showed statistically significant reduction in OV in group 1 with stripping three and six months after laparoscopy (p≤0.01) in comparison with OV before LPSC (Wilcoxon Signed Ranks test; p≤0.01). There was no significant difference between OV three and six months after operation in group 1. These results are presented on Table 6.

Wilcoxon Signed Ranks test	Comparison of OV after 3 months from LPSC with OV before LPSC	Comparison of OV after 6 months from LPSC with OV before LPSC	Comparison of OV after 6 months from LPSC with OV after 3 months from LPSC
Z	-6.154	-6.154	-1.791
p	p≤ 0.01	p≤ 0.01	p= 0.73 (n.s.)

Table 6: Comparison of OV after 3 and 6 months from LPSC with OV before LPSC in group 1 (stripping).

Statistical analysis showed increased AFC in group 1 with stripping 3 and 6 month after laparoscopy in comparison with result before operation and 6 months after LPSC in comparison with AFC three months after operation (Wilcoxon Signed Ranks-test; p≤0,01). These results are presented on Table 7.

There was no statistically significant difference for PI three months after LPSC in comparison with PI before operation in group 1. There was significant decreases for PI in group 1 with stripping 6 months after LPSC in comparison with PI before operation (Wilcoxon

Signed Ranks test; Z= -2.665, p≤0.01) and 6 months after operation in comparison with PI three months after LPSC (Wilcoxon Signed Ranks test; Z= -3.574, p≤0.01). These results are presented on Table 8.

Wilcoxon Signed Ranks test	AFC 3 months after LPSC in comparison with AFC before LPSC	AFC 6 months after LPSC in comparison with AFC before LPSC	AFC 6 months after LPSC in comparison with AFC 3 months after LPSC
Z	-5.159	-5.805	-5.558
p	≤0.01	≤0.01	≤0.01

Table 7: Comparison of AFC 3 and 6 months after LPSC with AFC before LPSC in group 1 (stripping).

Wilcoxon Signed Ranks test	PI 3 months after LPSC in comparison with PI before LPSC	PI 6 months after LPSC in comparison with PI before LPSC	PI 6 months after LPSC in comparison with PI 3 months after LPSC
Z	-1.405	-2.665	-3.574
p	0.16 (n.s.)	≤0.01	≤0.01

Table 8: Comparison of PI 3 and 6 months after LPSC with PI before LPSC, comparison of PI 6 months after LPSC with PI 3 months after LPSC (group 1).

Statistical analysis showed significant decrease in RI in the first group 3 and 6 months after LPSC in comparison with RI before operation (p≤0,01) and decrease of RI six months after LPSC in comparison with RI three months after LPSC (Wilcoxon Signed Ranks test; Z= -2.237, p≤0.05).

These results are presented on Table 9.

Wilcoxon Signed Ranks test	Comparison of RI 3 months after LPSC with RI before LPSC	Comparison of RI 6 months after LPSC with RI before LPSC	Comparison of RI 6 months after LPSC with RI 3 months after LPSC
Z	-3.377	-4.017	-2.237
p	≤0.01	≤0.01	≤0.05

Table 9: Comparison of RI 3 and 6 months after LPSC with RI before LPSC and RI 6 months after LPSC with RI 3 months after LPSC (group1).

Statistical analysis showed decrease in serum FSH levels three and six months after LPSC in comparison with FSH before operation and decrease in FSH levels 6 months after LPSC in comparison with FSH levels three months after LPSC (p≤0.01) in group 1. These results are presented on Table 10.

Wilcoxon Signed Ranks test	FSH 3 months after LPSC compared with FSH before LPSC (group 1)	FSH 6 months after LPSC compared with FSH before LPSC (group 1)	FSH 6 months after LPSC compared with FSH 3 months after LPSC (group 1)
Z	-2.230	-3.447	-2.680
p	≤0.05	≤0.01	≤0.01

Table 10: Comparison of FSH levels 3 and 6 months after LPSC with FSH levels before LPSC, comparison of FSH levels 6 months after LPSC with levels before LPSC (group 1).

Serum levels of E2 significantly increased three and six months after operation in comparison with E2 levels before operation. Also, there was increasing of E2 levels six months after LPSC in comparison with E2 levels three months after LPSC (p≤0.01) in group 1.

In the second group of patients operated with ablation statistical analysis showed significant decrease in OV three and six months after LPSC in comparison with OV before LPSC, also six months after LPSC in comparison with 3 months after LPSC (Wilcoxon Signed Ranks test; p≤0.01).

For AFC statistical analysis showed increase 3 and 6 months after LPSC in comparison with AFC before LPSC, also between 6 and 3 months after LPSC (Wilcoxon Signed Ranks test, p≤0.01).

For marker for ovarian vascularization (PI) statistical analysis in group 2 showed decrease in PI 3 and 6 months after LPSC in comparison with PI before LPSC, also there was decrease in PI six months after LPSC in comparison with PI three months after LPSC (Wilcoxon Signed Ranks test; p≤0.01).

For RI there was decrease 3 and 6 months after LPSC in comparison with RI before LPSC, also 6 months after LPSC in comparison with 3 months after LPSC (Wilcoxon Signed Ranks test; p≤0.01) in group 2.

In the second group non significant reduction for FSH values 3 months after LPSC have been found (p>0.05). There was significant reduction in FSH values 6 months after LPSC in comparison with FSH values before LPSC (Wilcoxon Signed Ranks test; p≤0.01). There was not significant difference in FSH levels 6 months after LPSC in comparison with FSH levels 3 months after LPSC (p= n.s.).

For E2 levels there was increasing of E2 levels 3 and 6 months after LPSC in comparison with values before LPSC, and 6 month after LPSC in comparison with E2 levels three months after LPSC (Wilcoxon Signed Ranks test; p≤0.01) in group 2.

For comparison of changes in all investigated variables in both groups in three segment of time (first three months after LPSC, first six months from LPSC, from third to sixth months after LPSC) Mann-Whitney-U test was used. Statistical analysis showed statistically significant percentage of decrease in OV in group 1 in the first segment of time in comparison with the group 2 (Mann-Whitney-U test; Z= -3,319, p≤0.01). Also there was significant decrease in percentage of decreasing of OV in the first group in second segment of time in comparison with the group 2 (Mann-Whitney-U test; Z= -3,612, p≤0.01). There was not significant decrease in percentage of decreasing of OV in the third segment of time in group 1 in comparison with group 2 (Mann-Whitney-U test; Z= -0.300, p= n.s.). These results are presented on Table 11.

Mann-Whitney test	Comparison of percentage of decreases in OV between both groups in first segment of time (from LPSC to third month after LPSC)	Comparison of percentage of decreases in OV between both groups in second segment of time (from LPSC to sixth month after LPSC)	Comparison of percentage of decreases in OV between both groups in third segment of time (from third months after LPSC to sixth month after LPSC)
Z	-3.319	-3.612	-0.300
p	≤0.01	≤0.01	n.s.

Table 11: Comparison of percentage of decrease in OV between two groups in three segment of time.

For AFC there was statistically significant increase in percentage of increasing of AFC in the group 2 in the third time segment (from 3 to 6 months after LPSC) in comparison with group 2 (Mann-Whitney-U test; Z= -2.282, p≤0.05). There was no difference between both groups for other segments of time (p= n.s.).

For PI there was no significant difference in percentage of decrease of PI between two groups in three segment of time.

For RI statistical analysis showed statistically significant decrease in percentage of decreasing of RI in group 1 in the first segment of time (Mann-Whitney-U test; Z= -3,378, p≤0.01) in comparison with the group 2. Also, there was significant difference in percentage of decreasing of RI group 1 for the second segment of time in comparison with group 2 (Mann-Whitney-U test; Z= -1.958, p= 0.05). There was no significant difference between two groups in the third segment of time (p= n.s.).

Statistical analysis showed no difference in percentage of decreasing of FSH levels in all three segment of time for both groups. There was significant difference in percentage of increasing of E2 levels in the first segment of time in the group 1 in comparison with group 2 (Mann-Whitney-U test; Z= -4.026, p≤0.01). Also there was significant difference in percentage of increasing of E2 levels for the second segment of time in group 1 in comparison with group 2 (Mann-Whitney-U test; Z= -2.123, p≤0.05). For the third segment of time there was statistically significant increasing in E2 levels in group 2 in comparison with group 1 (Mann-Whitney-U test; Z= -3.416, p≤0.01).

RMI was calculated for all patients enrolled in study with value ≤200. There was one recurrence six months after laparoscopy (2%) in group 1. On the other hand, there was recurrence of disease in 4 patients in group 2 (8%) after 3 months from LPSC and in two patients after six months. Histopathological analysis confirmed diagnosis for ovarian endometriomas in all operated patients enrolled in this study.

Discussion

There is disagreement between gynecologist which laparoscopic techniques to be used for operative treatment of patient with ovarian endometriomas when we think about ovarian reserve.

In our study we have found recurrence of disease in 2% in group 1 and in 8% in group 2. In study of Vercellini et al. from 2003 one year after operation 6.4% recurrence in group with stripping and 18.4% recurrence in group with ablation have been found [21]. Alborzi et al. in 2004 one year after operation 5.8% recurrence in group with stripping and 22.9% in group with ablation have been found [22].

From ultrasonographic markers for ovarian reserve OV and AFC were investigated in our study. Decreasing of OV was found in both groups in our study, but percentage of decreasing in OV was bigger in first group operated with stripping technique in the first three months after laparoscopy. Salem HA et al. in 2013 in their study have found decreasing in OV and AFC in both groups (operated with stripping and ablative technique) but in stripping group they had bigger diminished of ovarian reserve in comparison with group operated with ablative technique [23].

Candiani et al. in their study 2005 have found 33% reduction in OV three months after laparoscopic operation for ovarian endometrioma with stripping technique [24].

We have found increasing of AFC in both groups postoperatively. In first group AFC was 2.70±1.30 before LPSC, three months after operation was 4.14±1.71, six month after LPSC was 5.54±1.75. In second group AFC was 2.90±1.13 before operation, AFC was 4.36±1.50 after three months and 7.24±1.82 after six months. Increasing of AFC was found in both groups, but it was bigger in group operated with ablation in the third segment of time (from third to sixth month after LPSC). Decreasing of ovarian reserve is smaller in ablative technique. According to opinion of many authors maybe ovarian endometrioma lead to compression of ovarian tissue and therefore AFC was smaller and not real before operation. Rustamov O et al. in their study in 2016 found that surgery for ovarian endometriomas did not significantly affect AFC or FSH levels [25]. Almog et al. in their study in 2010 have found smaller AFC in ovary with endometrioma in comparison with AFC from contralateral ovary without endometrioma in the same patient [26].

Correlation between AFC and patients age have showed decreasing of AFC with increasing of age of patient in group 1. There was no correlation between AFC and age of the patients in group 2 for patients younger than 35 years. There was slow decreasing of AFC three month after operation in group 2. These results are similar with results of Richardson et al. 1987. They have found decreasing of AFC in patients beyond 37 years [27].

There are not too much articles for ovarian vascularization in patients with ovarian endometriomas. In study of Kurjak et al. in 1996 they have found good vascularization in the region of ovarian hillus in patient with ovarian endometriomas in 78.6% of cases. RI in this region was bigger than 0.45. In early phase of development of endometrioma in ovary angiogenesis was bigger and RI was 0.44±0.06. For advantage stages of endometriosis RI was higher (RI=0.51±0.09) [28]. In the study of La Torre et al. in 1998 they have found decreasing in PI and RI postoperatively in patients operated laparoscopically because of ovarian endometriomas. Median value for PI was 2.17 before operation and 1.59 after operation. Median value for RI was 0.81 before LPSC and 0.73 after operation [29]. In study of Porpora et al. 2014 they have found alteration in vascularization in 90% of patients (RI>0.8) operated laparoscopically because of ovarian endometrioma and three months after operation improvement in ovarian vascularization have been found [30]. In our study we have found decreasing of PI postoperatively in both groups, without difference between two groups. PI was 2.19±0.89, before operation, after three months 2.03±0.50, after six months 1.83±0.66 in first group with stripping. PI was 2.35±0.96 before LPSC, after three months 2.01±0.66, after six months 1.77±0.57 in the second group with ablation. For RI analysis has showed decreasing in both groups postoperatively, but decreasing of RI was bigger in first group in the first segment of time (from operation to third month after LPSC). RI was 0.80±0.14 before operation, 0.73±0.11 three months after LPSC and 0.70±0.10 six months after LPSC in group 1. At the same time, RI was 0.80±0.13 before operation, 0.76±0.11 three months after operation and 0.72±0.11 six months after LPSC. Results of our study showed that ovarian reserve was diminished more in patients operated with stripping technique with bigger decreasing in ovarian vascularization in this group. Because of that, surgeons must be carefull when operated patient with ovarian endometriomas because extensive electrocauterization lead to destruction of ovarian vascularization. Therefore, Donez J et al. 2010 present combinated technique for treatment of patients with ovarian endometriomas as combination of stripping and ablation which lead to smaller decreasing of ovarian reserve [31].

From hormonal markers for ovarian reserve in our study serum levels of FSH and E2 were investigated. There have been found decreasing of FSH levels in both groups postoperatively without difference in decreasing between groups. For E2 levels statistical analysis has found increasing of E2 levels in both groups postoperatively, but there was bigger percentual increasing in E2 levels in second group from third to sixth months postoperatively. This results are similar with the results of Biacchiardi et al. from 2011 [32]. They have found small increasing in FSH levels and no changes in E2 levels three and nine months after laparoscopic operation for ovarian endometriomas with stripping technique.

Results of our study showed that ovarian reserve was more diminished with stripping technique, because ovarian tissue is excised together with the endometriotic cyst wall in most patient. But stripping technique provides better results than ablative technique regarding cyst recurrence and pain symptoms, and subsequent spontaneous pregnancy in patients who were previously subfertile. On the other hand, smaller loss of ovarian tissue was found in patients operated with ablative technique.

Results of our study are limited because patients were evaluated only six months after laparoscopic operation. For evaluation of effect of laparoscopic operation of ovarian endometriomas on ovarian function long term evaluation and larger sample sizes are necessary.

Conclusions

Results of our study show that stripping technique for operating of ovarian endometriomas lead to bigger decrease in ovarian volume three and six months after laparoscopy, especially in the first three months after operation in comparison with ablative technique. Increasing of AFC was found in both groups, but this increasing was bigger in second group of patients operated with ablative technique. We can conclude that ovarian reserve was not so much diminished using ablative technique.

For markers for ovarian vascularisation: pulsatility index (PI) and resistance index (RI) we have found decreasing of these markers in both groups of patients, decreasing of RI was bigger in first group operated by stripping technique and in this group bigger disturbances in ovarian vascularization have been found in comparison with group 2 operated with ablation.

For hormonal markers for ovarian reserve FSH levels were decreased in both groups postoperatively. On the other hand, E2 levels were increased in both groups of patients after laparoscopy. We can conclude that ovarian reserve was not so much diminished using both laparoscopic techniques for treatment of ovarian endometriomas.

The results of our study show that ovarian reserve decreases after laparoscopic operation using both techniques.

Laparoscopic stripping of endometriomas reduces ovarian reserve more than ablation.

This must be carefully considered when laparoscopic extirpation of endometrioma is scheduled especially for patients with infertility or with already small ovarian reserve.

Competing Interests

The authors declare that they have no competing interests.

References

1. Gurates B, Bulun SE (2003) Endometriosis: the ultimate hormonal disease. Semin Reprod Med 21: 125-134.
2. Farquhar C (2007) Endometriosis. BMJ 334: 249-253.
3. Missmer SA, Cramer DW (2003) The epidemiology of endometriosis. Obstet Gynecol Clin North Am 30: 1-19.
4. Van Holsbeke C, Calster CV, Guerriero S, Savelli L, Leone F, et al. (2009) Imaging in gynaecology: How good are we in identifying endometriomas? Facts Views Vis Obgyn 1: 7-17.
5. Sayasneh A, Ekechi C, Ferrara L, Kaijser J, Stalder C, et al. (2015) The characteristic ultrasound features of specific types of ovarian pathology. Int J Oncol 46: 445-458.
6. Gougoutas CA, Siegelman ES, Hunt J, Outwater EK (2000) Pelvic endometriosis: various manifestations and MR imaging findings. AJR Am J Roentgenol 175: 353.
7. Dunselman GAJ, Vermeulen N, Becker C, Calhaz-Jorge C, D'Hoodge T, et al. (2014) ESHRE guideline: management of women with endometriosis. Hum Reprod 29: 400-412.
8. Leyland N, Casper R, Laberge P, Soucy R, Wolfman WL, et al. (2010) Endometriosis: Diagnosis and Management. SOGC Clinical practice guideline. J Obstet Gynaecol Can 32: 1-28.
9. Carnahan M, Fedor J, Agarwal A, Gupta S (2013) Ovarian endometrioma: Guidelines for selection of cases for surgical treatment or expectant management. Expert Rev Obstet Gynecol 8: 29-55.
10. Cihat Ü, Yildirim G (2014) Ovarian cystectomy in endometriomas: Combined approach. J Turk Ger Gynecol Assoc 15: 177-189.
11. Muzii L, Achilli C, Bergamini V, Candiani M, Garavaglia E, et al. (2016) Comparison between the stripping technique and the combined excisional/ ablative technique for the treatment of bilateral ovarian endometriomas: a multicentre RCT. Hum Reprod 31: 339-344.
12. Mandai M, Suzuki A, Matsumura N, Baba T, Yamaguchi K, et al. (2012) Clinical management of ovarian endometriotic cyst (chocolate cyst): Diagnosis, Medical Treatment, and Minimally Invasive Surgery. Curr Obstet Gynecol Rep 1: 16-24.
13. Donnez J, Donnez O, Dolmans MM (2014) Fertility preservation in women with ovarian endometriosis. Mt Medecine de la Reproduction, Gynécologie Endocrinologie 16: 259-268.
14. Donnez J, Lousse JC, Jadoul P, Squifflet J (2010) Laparoscopic management of endometriomas using a combined technique of excisional (cystectomy) and ablative surgery. Fertil Steril 94: 28-32.
15. Chen J, Huang D, Zhang J, Shi L, Li J, et al. (2021) The effect of laparoscopic excision and ablative surgery on ovarian reserve in patients with endometriomas: a retrospective study. Medicine 100: e24362.
16. Georgievska J, Sapunov S, Cekovska S, Vasilevska K (2014) Ovarian reserve after laparoscopic treatment of unilateral ovarian endometrioma. Acta Inform Med 22: 371-373.
17. Var T, Batioglu S, Tonguc E, Kahyaoglu I (2011) The effect of laparoscopic ovarian cystectomy versus coagulation in bilateral endometriomas on ovarian reserve as determined by antral follicle count and ovarian volume: a prospective randomized study. Fertil Steril 95: 2247-2250.
18. Hwu YM, Wu FS, Li SH, Sun FJ, Lin MH, et al. (2011) The impact of endometrioma and laparoscopic cystectomy on serum anti-Müllerian hormone levels. Reprod Biol Endocrinol 9: 80.
19. Cho HY, Park ST, Park SH, Kyung MS (2021) Anti-Mullerian hormone changes following laparoscopic ovarian cystectomy: a prospective comparative study. Int J Women's Health 13: 691-698.
20. Ziegler de D, Bessis R, Caetano J, Frydman R (1993) Value in gynecology of transvaginal pulsed and color Doppler. Study of ovarian vascularization. Contracept Fertil Sex 21: 63-70.
21. Vercellini P, Chapron C, De Giorgi O, Consonni D, Frontino G, et al. (2003) Coagulation or excision of ovarian endometriomas. Am J Obstet Gynecol 188: 606-610.
22. Alborzi S, Momtahan M, Parsanezhad ME, Dehbashi S, Zolghadri J, et al. (2004) A prospective randomized study comparing laparoscopic ovarian cystectomy versus fenestration and coagulation in patients with endometriomas. Fertil Steril 82: 1633-1637.
23. Salem HA, Hegab HM, Elkaffash DM, Azb H, Hosny TA, et al. (2013) Assesment of the ovarian reserve before and after laparoscopic surgery using two different techniques for ovarian endometrioma. J Dent Med Sci 6: 43-48.
24. Candiani M, Barbieri M, Bottani B, Bertulessi C, Vignali M, et al. (2005) Ovarian recovery after laparoscopic enucleation of ovarian cysts: insights from echographic short-term postsurgical follow-up. J Minim Invasive Gynec 12: 409-414.
25. Rustamov O, Krishnan M, Roberts AS, Fitzgerald TC (2016) Effect of salpingectomy, ovarian cystectomy and unilateral salpingo-oophorectomy on ovarian reserve. Gynecol Surg 13: 173-178.
26. Almog B, Shehata F, Sheizaf B, Tan SL, Tulandi T, et al. (2011) Effects of ovarian endometrioma on the number of oocytes retrieved for in vitro fertilization. Fertil Steril 95: 525-527.
27. Richardson SJ, Senikas V, Nelson JF (1987) Follicular depletion during the menopausal transition evidence for accelerated loss and ultimate exhaustion. J Clin Endocrinol Metab 65: 1231-1237.

28. Kurjak A, Kupesic S (1994) Scoring system for prediction of ovarian endometriosis based on transvaginal color and pulsed Doppler sonography. Fertil Steril 62: 81-88.

29. La Torre R, Montanino OM, Marchiani E, Boninfante M, Montanino G, et al. (1998) Ovarian blood flow before and after conservative laparoscopic treatment for endometrioma. Clin Exp Obstet Gynecol 25: 12-14.

30. Porpora MG, Tomao F, Manganaro L, Yazdanian D, Fuggetta E, et al. (2014) Impaired uterine artery flow associated with the presence of ovarian endometrioma: preliminary results of a prospective study. J Ovarian Res 7: 1.

31. Donnez J, Lousse JC, Jadoul P, Donnez O, Squifflet J, et al. (2010) Laparoscopic management of endometriomas using a combined technique of excisional (cystectomy) and ablative surgery. Fertil Steril 94: 28-32.

32. Biacchiardi CP, Piane LD, Camanni M, Deltetto F, Delpiano EM, et al. (2011) Laparoscopic stripping of endometrioma negatively affects ovarian follicular reserve even performed by experienced surgeons. Reprod Bio Med Online 23: 740-746.