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Evaluation of ovarian reserve parameters in patients who underwent detorsion because of ovarian torsion

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ABSTRACT

Objectives: Ovarian torsion is a gynecologic emergency that can cause loss of ovarian function. The aim of the study was to evaluate the ovarian reserve of the patients who were operated for detorsion because of ovarian torsion.

Materials and Methods: The medical records of the patients who underwent detorsion for ovarian torsion in our clinic between January 2013 and June 2017 were investigated. Ovarian reserve parameters including ovarian volume, antral follicle count and ovarian artery resistance index (RI) were evaluated by ultrasonography in post-operational period. Patients that had oophorectomy due to torsion or who had another ovarian surgery before or after torsion and pregnant women were not included in the study. The ovarian volume, antral follicle count and ovarian artery RI in the operated side were compared with the contralateral ovary.

Results: Thirty-four women meeting the inclusion criteria were examined by ultrasonography in the early follicular phase of their cycles. Antral follicle count, ovarian volume and ovarian artery RI were decreased significantly ($p<0.001$, $p<0.001$ and $p<0.001$, respectively) in the operated ovary compared to the contralateral ovary. Sixteen patients who were treated by detorsion, underwent cystectomy at the same time. No significant difference was observed in ovarian reserve of the patients who had cystectomy together with detorsion compared to those who were operated only with detorsion.

Conclusion: Antral follicle count, ovarian volume and ovarian artery RI were significantly decreased after detorsion operation in the operated side compared to the contralateral ovary.

Keywords: Ovarian torsion; detorsion; ovarian reserve; antral follicle count; ovarian volume

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INTRODUCTION

Ovarian torsion is a gynaecologic emergency as a result of rotation of adnexal structures or the ovary on its ligamentous support.[1] Its prevalence is 2.7% and is usually seen in reproductive-age women.[2]

Ovarian torsion may cause necrosis, peritonitis, and ovarian function loss. Therefore, a timely diagnosis is important to maintain ovarian function and future fertility.[3] However, because of non-specific signs and symptoms, diagnosis and surgical intervention may be delayed. Colour Doppler ultrasonography might be useful that an abnormal flow or the absence of ovarian blood flow is detected when correlated with clinical findings.[4]

In ovarian torsion, damage to ovarian tissue occurs because of both ischemia and reperfusion after detorsion. In ovarian detorsion, reactive oxygen species accumulate in cells and lead to a decrease in the hormonal function of the ovary and ovarian reserve.[5]

In the current study, we aimed to evaluate ovarian reserve by counting antral follicle count (AFC), estimating ovarian volume, and assessing the ovarian artery resistance index (RI) in the operated ovary compared to the contralateral ovary.

MATERIALS AND METHODS

The medical records of the patients who underwent detorsion for ovarian torsion in our clinic between January 2013 and June 2017 were investigated. Patients treated with detorsion between the age 20-35 years were included in the study. The exclusion criteria were as follows: Patients treated with oophorectomy, those with a history of ovarian surgery before or after ovarian torsion, and those who were pregnant. The study was approved by the Local Ethics Committee of University of Health Sciences Türkiye, Taksim Training and Research Hospital (date: 07.02.2018, no: 101). All participants provided written informed consent, according to principles outlined by the Declaration of Helsinki (2013).

There were 48 patients operated on the relevant dates in our clinic because of ovarian torsion. A total of 34 patients who met the inclusion criteria were evaluated by ultrasonography (DC-8 EXP Ultrasound System; Mindray Medical, Colombia). All transvaginal ultrasounds (TVUSGs) were performed by the same specialist (NK) during the follicular period of the menstrual cycle (3^{rd}-5^{th} days of the cycle). The specialist who performed TVUSG was not informed about on which side of the ovary the surgery was performed. The following parameters were evaluated using TVUSG:

1. The AFC of the detorsioned ovary and the ovary on the other side-follicles between 2 and 10 mm in the ovary were evaluated as antral follicles.

2. The volumes of the detorsioned ovary and the ovary on the other side (length X, width X, and depth X 0.52) were calculated using the method defined by Gohari.[6]

3. The RIs of the detorsioned ovary and the ovary on the other side were calculated. Ovarian arteries were seen in the infundibulopelvic ligament in the inferolateral ovary.[7] The RI was measured three times and averaged after waveforms were seen. It was calculated by dividing the peak systolic flow and end-diastolic mean blood flow by the peak systolic blood flow.

AFC, ovarian volume, and RI were compared between the detorsion ovary and contralateral ovary. Comparison of ovaries operated on with detorsion and cystectomy with detorsion. Additionally, the same parameters were compared between the ovaries operated on with detorsion and the ovaries performed on with detorsion cystectomy. Demographic characteristics of the patients, sides operated, whether or not concomitant cystectomy was applied, and operation method were evaluated.

Statistical Analysis

SPSS (Statistical Package for Social Sciences) for Windows 20.0 program was used for statistical analysis of the findings obtained from the study. The distribution of continuous variables was evaluated by the Kolmogorov-Smirnov test. The variables with a normal distribution and belonging to two groups were compared with paired-samples t-test. The Mann-Whitney U test was used to compare variables without a normal distribution. Continuous variables were given as mean ± standard deviation; $p<0.05$ was considered statistically significant.

RESULTS

Our study was performed on 34 patients who underwent detorsion because of torsion. The mean patient age was 27.9±7.3 years. The mean parity number was found to be 1.3±1.2. The period from the operation to the evaluation of TVUSG was 15.5±12.8 months. As presented in Table 1, 16 of the 34 patients were operated with concomitant cystectomy. Torsion was observed in the right side in 58.8% of the patients and in the left side in 41.2%. None of the patients required a reoperation.

The mean AFC was 3.4±2.0 in the detorsioned ovary and 7.1±2.8 in the ovary on the other side. The mean AFC was significantly lower in the detorsioned ovary compared to the ovary on the other side ($p<0.001$). Ovarian volume was found to be 5.5±3.1 cm^3 in the detorsioned ovary and 11.2±4.8 cm^3 in the ovary on the other side. The volume of the detorsioned ovary was significantly

lower (p<0.001; Table 2). The ovarian artery RI was 1.06±0.2 in the detorsioned ovary and 0.80±0.1 in the ovary on the other side. The ovarian artery RI in the detorsioned ovary was significantly higher than that in the ovary on the other side (p>0.001).

Sixteen patients underwent concomitant cystectomy with detorsion. Of 16 of these cystectomy pathology results, 7 were reported as dermoid, 5 as serous cystadenoma and 4 as corpus luteum cyst. Patients who underwent concomitant cystectomy with detorsion did not show any difference in terms of AFC, ovarian volume, and ovarian artery RI compared to those who underwent only detorsion (p=0.360, p=0.574, p=0.673, respectively). No difference was found between the patients who underwent only detorsion and who underwent concomitant cystectomy with respect to the AFC and volume difference of the contralateral ovary (Table 3).

Table 1. Demographic data of the patients

	n=34
Age (years)	27.9±7.3
Gravida (n)	1.4±1.2
Parity (n)	1.3±1.2
Torsion side Right ovary Left ovary	 20 (58.8%) 14 (41.2%)
Operation Laparotomy Laparoscopy	 25 (73.5%) 9 (26.5%)
Operation Detorsion+cystectomy Detorsion	 16 (47%) 18 (53%)
Time after surgery (months)	15.5±12.8

Data are expressed as mean (± standard deviation) or number (%)

DISCUSSION

In ovarian torsion, damage to the ovarian tissue occurs because of torsion and reperfusion after detorsion. Because ischaemia, congestion, haemorrhage, and necrosis would occur in the tissue because of torsion, this also reflects on ovarian functions and affects them negatively. Nowadays, the treatment approach in ovarian torsion is detorsion even if it purports as ovary necrosis, and thus, it is aimed to protect ovarian functions and reserve.[8] Ovarian reserve tests are known to represent the ovarian follicle pool that remains in the ovary.[9] The commonly used ovarian reserve tests are antimullerian hormone, AFC, and basal follicle stimulating hormone.[10,11] In this study, we aimed to evaluate the ovarian volume, AFC, and ovarian artery RI of the detorsioned ovary compared to the ovary on the other side. We found that the AFC and ovarian volume were significantly decreased in the detorsioned ovary compared to the ovary on the other side and observed that the ovarian artery RI was significantly increased in the detorsioned ovary compared to the ovary on the other side. We found that the application of cystectomy or only detorsion had no effect on these parameters.

In their study that evaluated the ovarian parenchyma of the patients on whom oophorectomy was performed because of torsion, Galinier et al.[12] have shown that in most of the cases, although ovaries seemed necrotic macroscopically, they were viable microscopically. They have concluded that applying a conservative approach by the detorsion of ovaries with a blue-black appearance is safe and effective. However, in terms of ovarian reserve, the presence of a viable tissue in the detorsioned ovary may not be a sign of a healthy cohort pool.[13] As shown in many studies, not only ischaemia but reperfusion may also adversely affect the follicle cohort.[14] The basic mechanism

Table 2. Ovarian reserve parameters of torsioned ovary compared to contralateral ovary

	Torsioned ovary	Contralateral ovary	p-value
Antral follicle count (n)	3.4±2.0	7.1±2.8	**<0.001**
Ovarian volume (cm^3)	5.5±3.1	11.2±4.8	**<0.001**
Ovarian artery RI	1.06±0.2	0.80±0.10	**<0.001**

RI: Resistance index, data are expressed as mean (± standard deviation), p<0.05 was considered statistically significant

Table 3. Comparison of ovaries operated with detorsion and cystectomy versus with detorsion

	Detorsion+cystectomy (n=16)	Detorsion (n=18)	p-value
Age	28.1±8.26	28.1±6.03	0.996
Antral follicle count (n)	2.5 (2)	4.0 (2)	0.360
Ovarian volume (cm^3)	5.0 (5.6)	5.4 (3.7)	0.574
Ovarian artery RI	1.10 (0.3)	1.10 (0.3)	0.673

RI: Resistance index, data are expressed as median (interquartile), p<0.05 was considered statistically significant

here is the free radicals and reactive oxygen species formed by providing excessive oxygen with reperfusion to the tissue that is ischaemic tiessue.[15] In addition, some authors claim that damage to ovarian tissue increases after detorsion.[16]

In a study that included the highest number of patients on follicular development after detorsion (102 patients), more than 90% of ovaries were found to have a normal follicular development.[17] This study demonstrates follicle development, but no evaluation has been made for ovarian reserve.

Although there is no ideal test showing ovarian reserve, it is typically evaluated by hormonal tests and ultrasonographically.[18] According to the design of the current study, evaluation of AFC was the most appropriate approach. Whether or not there is a change in ovarian reserve compared to the AFC in normal ovaries of the patients was presented. In our study, we found that AFC was significantly decreased in the torsioned ovary compared to the ovary on the other side. In contrast to the study where Bozdag et al.[17] have evaluated AFC after 18 detorsions, no difference was found between the mean AFC of the torsioned and normal ovaries. However, in this study, AFC was greater than 12 in eight patients, suggesting that a significant part of this patient group could be having polycystic ovary syndrome and that the change in AFC would not be obvious because of the high follicle cohort in these patients after detorsion.[18] Similarly, in a study where Yasa et al.[5] evaluated AFC after 11 detorsions, it was found that the mean AFC that they observed in the first month post-operatively decreased compared to the normal ovary, although they did not reach statistical significance. Another factor may be the time passed from the beginning of the symptoms of the patients to the surgery because the change in ovarian reserve is associated with the duration of torsion. Yasa et al.[5] found the mean time to surgery as 13.1±9.5 hours. The fact that these cases were diagnosed early and were rapidly taken into operation may be another reason for the absence of a change in ovarian reserve. We cannot comment on whether or not there was a delay in the diagnosis and operation decision in the patient group because we have not seen patients who underwent surgery before the operation and did not question these times, which is one of the limitations of our study.

According to a recent study, ovarian reserve can recover with time even though a significant decrease might initially be noticed after ovarian surgery.[19] Therefore, we evaluated ovarian reserve at least 6 months after the operation.

Cagnacci et al.[20] evaluated patients undergoing laparoscopic cystectomy by ovarian volume, AFC, and ovarian artery RI. They concluded that cystectomy was associated with decreased ovarian reserve, regardless of the histological type and size of the removed cyst.20 Cystectomy was performed in addition to detorsion in 14 of the 34 patients, but when we compared the detorsion-only group with the detorsion-cystectomy group, we found no difference between the two groups in terms of AFC, ovarian volume, and ovarian artery RI. Therefore, we can say that the decrease in AFC and ovarian volume is only due to damage secondary to torsion.

Ovarian velocimetry is not frequently used in the evaluation of post-operative damage. The RI is an indicator of vascular resistance to blood flow and is associated with flow in the microvascular bed.[21] Studies of endometrioma and non-endometrioma cystectomy have also shown increased RI in the operated ovary.[22] In our study, similar to these two studies, the RI of the detorsioned ovary was significantly higher.[21] The differences in the RI between the torsioned ovary and the ovary on the other side may be due to volume differences between the two.

Study Limitations

The most important limitation of our study is that these patients were not evaluated pre-operatively. Moreover, there was no record of the time between the beginning of the symptoms of the patients to the operation. Another limitation of our study is that the time elapsed after surgery and the time the patients were evaluated differed due to the design of our study. However, the strength of our study is the lack of previous studies on this topic and the comparison of both detorsion ovaries, detorsion and cystectomized patients concerning surgical technique. Another strength is that a single operator evaluated all patients.

CONCLUSION

Ovarian reserve based on AFC, ovarian volume, and ovarian stromal flow seems to be negatively affected in patients treated with detorsion because of ovarian torsion. These results showed that ovarian reserve is compromised in patients with ovarian torsion. Clinical studies with larger cohorts should be performed to clarify these results and also serial measurements of these ovarian reserve parameters before and after torsion might highlight the pathophysiological mechanisms.

ETHICS

Ethics Committee Approval: The study was approved by the Local Ethics Committee of University of Health Sciences Türkiye, Taksim Training and Research Hospital (date: 07.02.2018, no: 101).

Informed Consent: Informed consent was obtained from all participants included in the study.

Contributions

Concept: M.K., N.K.; Design: M.K., B.A.Ç.; Data Collection or Processing: M.K.; Analysis or Interpretation: G.Y.; Literature Search: Gö.Y.; Writing: M.K., N.K.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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