

ORIGINAL ARTICLE

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Evaluation of adnexial torsion between adult and adolescent women

^{ID}Tunay Kiremitli¹, ^{ID}Melike Doganay², ^{ID}Sevil Kiremitli¹, ^{ID}Aytekin Tokmak³, ^{ID}Burak Akselim⁴¹Erzincan Binali Yildirim University, Faculty of Medicine, Department of Obstetrics and Gynecology, Erzincan, Turkey²Ankara City Hospital, Department of Obstetrics and Gynecology, Ankara, Turkey³Mersin City Training and Research Hospital, Department of Obstetrics and Gynecology, Mersin, Turkey⁴Bursa Yuksek Ihtisas Training and Research Hospital, Department of Obstetrics and Gynecology, Bursa, Turkey

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Abstract

This study aimed to assess surgical procedures and surgical techniques employed in the management of adnexal torsion and the intraoperative and pathological exam findings in cases of adnexal torsion by retrospective review of records of patients who underwent surgery due to adnexal torsion. We retrospectively studied the medical records of 178 patients who had surgery due to adnexal torsion or who were incidentally diagnosed with adnexal torsion when undergoing elective surgery between January 2008 and June 2014 in Dr. Zekai Tahir Burak Women's Health Training and Research Hospital. Patients were divided into two groups, adolescent and adult, and characteristics between the groups were compared. Adnexal torsion was most frequently seen between ages 20-39 and was mainly managed conservatively and laparoscopically. 70.8% of patients had an adnexal mass, and most of these masses were ≥ 5 cm. Serous cystadenomas, hemorrhage-congestion, and mature cystic teratomas were most frequently identified on pathological examination. While the adnexal mass size was smaller in the adolescent group, the number of torsions was higher in the adolescent group ($p < 0.05$). Additionally, a conservative surgical approach was more commonly preferred in the adolescent group when compared to the adult group, and laparoscopy was the surgical technique more commonly employed in adolescents ($p < 0.05$). Fertility is essential in adolescent patients; one must exert greater caution and swiftness in the diagnosis and treatment of these patients. Laparoscopy, being a minimally invasive surgical procedure, must be the first treatment of choice.

Keywords: Adnexal torsion, gynecological emergency, laparoscopy, ovarian torsion, pathology of adnexal torsion

Introduction

Adnexal torsion, which is defined as the complete or partial rotation of the ovary, fallopian tube, or both around their vascular axis, is a surgical emergency that is more common, especially in women of reproductive age [1]. It ranks fifth in gynecological emergencies, and constitutes approximately 3% of them [1, 2]. Patients often apply with sudden onset of abdominal pain. Confirmation of the diagnosis requires urgent surgical intervention, and morbidity may increase if surgery is delayed. Pain may disappear as a result of progressive nerve and tissue damage in delayed surgery [3]. Although its etiology is not known precisely, it is thought that adnexal torsion occurs due to the mobility of the supportive ligaments like ovarian and infundibulopelvic ligaments. In the case of torsion, both ligaments are partially strangulated, and thus

blood flow is blocked. As a result, adnexal edema, discoloration, ischemia, and necrosis develop. Adnexal damage can be irreversible [4].

A cross-sectional study on adnexal torsions was planned by retrospectively scanning 178 patients' files for adnexal torsion, the types of operations performed on the patients, the surgical technique used, intraoperative findings, and pathology results were recorded.

Most of the studies on adnexal torsion have been conducted in adolescent patients and childhood. Therefore in our study, we divided the two groups, adolescent and adult, analyzed the differences between these groups. In some literature publications, patients aged 24 and over are considered the adult patient group. It has been suggested that the reason for this is that physical and psychiatric development continues until the age of 24 [5-7]. In our literature review, we could not find a study examining the differences between adult and pre-adult groups in adnexal torsion cases. This study examines cases of adnexal torsion and compares intraoperative evaluations and pathology results between

*Corresponding Author: Burak Akselim, Bursa Yuksek Ihtisas Training and Research Hospital, Department of Obstetrics and Gynecology, Bursa, Turkey
E-mail: burakakselim@hotmail.com

adolescent and adult groups. To our knowledge, our study will be the first study in the literature to examine the differences of patients operated for torsion according to age groups.

Materials and Methods

This study was performed in accordance with the ethical standards of the Helsinki Declaration, and Ethical committee approval was obtained in the decision of the Hospital Education Planning and Coordination Board, dated 28 November 2013 and numbered 5. The files of a total of 178 patients who were urgently or electively operated on adnexal torsion and who were found to have incidental adnexal torsion during elective surgery from the Gynecology and Infertility Services of Dr. Zekai Tahir Burak Women's Health Education and Research Hospital were retrospectively reviewed and included. Patients' age, parity status, previous abdominal operation, WBC, CRP, CA-125, operation-related information, and postoperative histopathological results of all cases were recorded. The patients were divided into two groups according to their age:

I. Group: Patients $\leq$ 24 years of age

II. Group: Patients $>$ 24 years old

Between these two groups, the torsion region, cysts or tumors, the number of torsions, histopathological results, white blood cell, CRP, CA-125 values, the technique, and histopathological results of the operation were statistically compared.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) 22 programs was used to analyze the data.

The suitability of univariate data to normal distribution was examined by considering the Kolmogorov-Smirnov test and Shapiro-Wilk test; Parametric methods were used to analyze variables with normal distribution, and non-parametric methods were used in the analysis of variables that did not have a normal distribution. Independent-Samples T-test and Mann-Whitney U test were used to compare two independent groups. Spearman Correlation test was used to examine the correlations of variables with each other. Comparison of categorical data was tested with the Pearson Chi-Square test. Quantitative data are expressed in tables

as mean $\pm$ std. (Standard deviation) Moreover, median $\pm$ (minimum-maximum) values. Categorical data are expressed as n (number) and percentages (%). The data were analyzed at a 95% confidence level, and a p-value less than 0.05 was considered significant.

Results

The mean age of 178 patients in our study group was 29.4 $\pm$ 12.6 years. While the youngest patient was a 12-day-old newborn, the oldest patient was 82 years old. All patients applied to the hospital with abdominal pain. Two of our patients had recurrent torsion. One of the patients with recurrent torsion was torsioned from the same side again, while the other patient had adnexa torsion on the opposite side.

The distributions of patients by parity, previous abdominal surgery, location of torsion, and presence of cyst/mass are shown in table 1.

One hundred twenty-six patients had ovarian cysts, masses, or tumors ($p < 0.05$). The mass size was over 5 cm in 78.8% of these patients. While the size of the cyst was less than 5 cm in 26 patients (20.6%), 6-10 cm in 62 patients (49.2%), 11-15 cm in 28 patients (22.2%), and over 15 cm in 10 patients (8%) was found.

In our study group, 67.4% of the patients were operated laparoscopically, a laparotomy with a midline incision was preferred in 16.9 %, and a Pfannenstiel incision in 15.7%. In 7 patients, although the operation started laparoscopically, laparotomy had being passed after intraoperative evaluation. The operation was completed 6 of them with a Pfannenstiel incision, while only one was completed with a midline incision.

When we look at the operations performed, the operation was terminated with the only detorsion in 38 patients. In comparison, the existing cyst/mass after detorsion was totally/partially excised, or sample material for pathology was taken from the cyst capsule after cyst aspiration in 78 patients. Salpingo-oophorectomy/oophorectomy was performed in 50 patients, and TAH+BSO was performed in 12 patients.

Semitorsion and one turn of torsion were observed in 47.2% of the patients included in our study, and the number of torsion turns shown in Table 2.

Table 1. Distribution of torsion patients by parity, previous abdominal operation, location of torsion and presence of cyst

		n
Parity	Nulliparous	91 (51.1%)
	Multiparous	87 (48.9%)
Previous abdominal surgery	Previous abdominal surgery (-)	142 (79.8%)
	Previous abdominal surgery (+)	36 (20.2%)
	Laparotomy	26 (15.7%)
	Cesarean	20 (11.2%)
	Laparoscopy	10 (5.6%)
	Other	6 (3.4%)
Side	Right adnex	91 (51.1%)
	Left adnex	87 (48.9%)
Cyst / mass / tumor	Cyst / mass / tumor (+)	126 (70.8%)
	Cyst / mass / tumor (-)	52 (29.2%)

Table 2. Distribution of the number of torsions

Number of torsion turns	n (%)
1 turn/semitorsiyon	84 (47.2%)
2 turn	45 (25.3%)
3 turn	34 (19.1%)
4 turn	11 (6.2%)
5 turn	2 (1.1%)
Unspecified	2 (1.1%)

Pathologic material was sent from 145 of 178 patients. Pathological results are shown in Table 3. The borderline tumor was detected in 2 patients, and malignant pathology was reported in 2 patients. Two of these patients were reported as malignant epithelial tumors. Also, 6 of our patients were normal intrauterine pregnant. The mature cystic teratoma (33.3%) was observed in 2 of these patients. Two patients had an ectopic pregnancy, and torsion was observed in the adnexa on the ectopic pregnancy side.

Ovarian fixation was performed intraoperatively in 45 (25.3%) of the patients.

Sacrouterine ligament fixation of the ovary was preferred in 23 (12.3%) patients while shortening sutures were made to the utero-

ovarian ligament in 16 (9%) also the adnexa was fixed to the round ligament in the other six patients.

In our study group, laparoscopy was preferred in 84.6% of the nulliparous patients in terms of operation technique, while this rate was 49.4% in the multiparous patient and was statistically significant ($p<0.05$). While detorsion or detorsion+cystectomy was preferred in 84.6% of nulliparous patients, this rate was 45.3% in multiparous patients, and a statistically significant difference was found ($p<0.05$).

While the patients' mean age was 16.9 ± 5.1 in the I. group, the mean age of the II. group was 35.5 ± 10.6 (Table 4).

Table 3. Comparison of pathology results between Adolescent and Adult groups

	Group 1 Adolescent Group	Group 2 Adult Group	Total	P
Mature cystic teratoma	11 19.3%	14 11.6%	25 14%	0.166
Serous Cystadenoma	9 15.8%	19 15.7%	28 15.7%	0.988
Mucinous Cystadenoma	2 3.5%	17 14%	19 10.7%	0.034
Follicle Cyst	2 3.5%	8 6.6%	10 5.6%	0.402
Fibroma	0 0%	13 10.7%	13 7.3%	0.010
Paratubal Cyst	3 5.3%	6 5%	9 5.1%	0.931
Endometrioid	1 1.8%	5 4.1%	6 3.4%	0.412
Endometrioma	1 1.8%	2 1.7%	3 1.7%	0.961
Ectopic Pregnancy	1 1.8%	1 0.8%	2 1.1%	0.584
Borderline ovarian tumor	1 1.8%	1 0.8%	2 1.1%	0.584
Malign ovarian tumor	0 0%	2 1.7%	2 1.1%	0.329
Hemorrhage Congestion	9 15.8%	17 14%	26 14.6%	0.759
No pathology	17 29.8%	16 13.2%	33 18.5%	0.008
Total	57	121	178	

The mean mass size was 7.5 ± 3.5 cm in the I. group and 10.3 ± 5.3 cm in the II. group, this difference was statistically significant ($p < 0.05$) (Table 4). While the median value of the torsion number in the I. group was 2, it was 1 in the II. group, and the difference was statistically significant ($p < 0.05$) (Table 4).

When the patients in the study group were compared in terms of the operation performed, conservative surgery (detorsion/detorsion+cystectomy) was preferred in 79% of the patients in the I. group. In comparison, this rate was 59.2% in the II. group ($p < 0.05$) (Table 5).

Terms of operation technique; while the choice of laparoscopy was higher in the adolescent group, a midline incision was preferred more in the adult group ($p < 0.05$).

Torsioned fibroma and mucinous cystadenoma were more common in group II, while detorsion only was more preferred in group I ($p < 0.05$) (Table 3).

A significant relationship was found between their ages and the size of the cyst/mass in our study group. Cyst/mass/tumor size was found to increase as the patient's age increased ($p < 0.05$). The number of torsions was decreasing with increasing age ($p < 0.05$).

Table 4. Comparison of the adolescent group and the adult group in terms of cyst size, torsion number, WBC, CRP and CA-125 values

	Group 1 (Adolescent) (n:57)	Group 2 (Adultt) (n:121)	p
Age	16.9 ± 5.1	35.5 ± 10.6	<0.001
Cyst size (cm)	7.5 ± 3.5	10.3 ± 5.3	0.002
Number of torsions (median)	2 (1-4)	1(1-5)	<0.001
WBC ($\times 10^3 / \text{mm}^3$)	10.2 ± 3.5	10.3 ± 3.7	0.883
CRP (mg/L)	1.3 (0.1-278.6)	5.3(0.11-174.0)	0.898
CA125 (U/ml)	15.2 (8.7-59.3)	13.3 (6.0-113.0)	0.799

Table 5. Comparison of the operation, technique and fixation performed in torsion patients in adolescent and adult groups

		Adolescent Group	Adult Group	Total	p
Operation	Detorsion	18 31.6%	20 16.5%	38 21.3%	0.024
	Detorsion + cystectomy	27 47.4%	51 42.1%	78 43.8%	0.513
	Salpingo-oophorectomy / oophorectomy	12 21%	38 31.4%	50 28.1%	0.152
	TAH+BSO	0 0%	12 9.9%	12 6.7%	0.014
	Conservative surgery (detorsion / detorsion + cystectomy)	45 79%	71 59.2%	116 65.5%	0.008
Operation Technique	Radical surgery (salpingo-oophorectomy / oophorectomy / TAH + BSO)	12 21%	50 41.3%	62 34.8%	
	Laparoscopy	46 80.7%	74 61.2%	120 67.4%	0.015
	Pfannenstiel incision	8 14.3%	22 18.2%	30 16.9%	0.521
	Midline incision	3 5.3%	25 20.7%	28 15.7%	0.008
	Yes	17 30.4%	28 23.3%	45 25.6%	0.320
Fixation	No	39 69.6%	92 76.7%	131 74.4%	

Discussion

Adnexal torsion can occur in all age groups in women, and it emerges most common in the reproductive period [1, 8, 9]. It is a gynecological emergency that is difficult to diagnose preoperatively and also requires urgent surgical intervention.

Although imaging methods used for diagnosis, the definitive diagnosis must be confirmed intraoperatively [10]. Nowadays, laparoscopy, which is used more frequently in surgical diagnosis and treatment, is applied as the first choice due to the less postoperative hospital stay and surgery-related pain and higher patient satisfaction [11, 12]. In our study, also, torsion was seen

more common in patients of reproductive age. When we look at the patients' age distribution in the study, we detected that adnexal torsion was seen more commonly in the range of 20-39 age. In our study group, laparoscopy is the first choice in both groups; the use of laparoscopy in group I was more than group II and was statistically significant. The reason for this difference in adult women may that, larger size of the mass, more possibility of the malignancy, some of the patients complete their fertility and have the possibility of accompanying pathologies. Nevertheless, recently, laparoscopy has been used more frequently for both groups, thanks to surgical technique and experience development.

According to ACOG recommendation, if ovarian torsion is suspected, diagnostic laparoscopy should be performed without wasting time to preserve ovarian function and future fertility [13]. Cohen et al. had evaluated 66 laparoscopies performed with a pre-diagnosis of adnexal torsion. They detected had adnexal torsion in 29 (44%) cases. Despite this high false positivity, they recommended performing laparoscopy for every suspected case [14]. Since we only included patients with adnexal torsion in our study, we can not provide data on laparoscopy sensitivity. We know that this is a limitation of our study. However, nowadays, we perform diagnostic laparoscopy on all patients with suspected adnexal torsion in our clinic.

Although any weight increase in the adnexal area increases torsion risk, torsion can also occur in normal adnexa without any adnexal pathology. In the literature, the most frequent histopathological result was mature cystic teratoma in torsion cases with an adnexal mass [15]. Balci et al. detected an adnexal mass in 97.3% of the patients in their study, including 150 surgically treated adnexal torsion patients. They reported that mature cystic teratoma (32%) was the most common pathologic result [16]. Also malignancy was reported in 2% of torsion cases [15]. In our study, adnexal mass was detected in 70.8% of the patients. In our pathological examination, the most common findings were serous cystadenoma, hemorrhage-congestion finding, the pathological finding of torsion, and mature cystic teratoma. By the literature, our malignancy rate was 2.2%. The number of patients without pathology in group I was significantly higher than the group II. It is possible that the reason for this was the thought of every attempt to be made in these patients who had not completed their fertility will affect the ovarian reserve and follicle development. The bulletin published by ACOG in 2019 has been reported that a cystectomy does not need to be performed at the time of detorsion because it may cause additional trauma. The surgeon may consider incision and drainage for large cysts, and ultrasonographic examination was recommended to evaluate the cyst in postoperative 6–12 weeks [13]. In the same bulletin, detorsion and preservation of adnexal structures in the torsioned ovary with a minimally invasive surgical intervention was recommended. It was stated that the appearance of the ovary should be background in deciding which surgery will be performed [13]. The preference for conservative surgery in treatment has gradually increased over time and reached a rate of 90% in some series [9, 17, 18]. Previously, the radical surgical approach was used more frequently in cases of adnexal torsion because detorsion was thought to increase the risk of embolism [19]. In the literature, the incidence of pulmonary embolism in adnexal torsion cases has been reported as 0.2%, and ovarian detorsion has not been shown to increase this risk [20]. Similarly, no thromboembolism

case has been reported after detorsion in recent studies [17, 21-23]. Conservative surgical approach rate was found to be 65.1% in our study, and it was observed that conservative treatment was markedly preferred more in group I among the groups. No thromboembolic complication was encountered after detorsion in our patient group.

Cysts in the adnexal area should be cystectomy for histopathological examination, or a biopsy should be taken if the cyst is aspirated [19]. In our study, the biopsy was taken from the capsule after total/partial excision or aspiration from adnexal cysts.

It has been reported that torsion occurs more frequently in cases where the ovary's size is over 5 cm and/or the mass size is over 5 cm [3, 24, 25]. However, if the ovary or mass is too large, the possibility of torsion decreases due to the restriction of the adnexa's movement in the pelvis. This limit value has not been reported in the studies conducted [3]. By the literature, our study showed that while in approximately 80% of torsion patients with ovarian mass (the mass size was over 5 cm), and when the size of the mass increased over 15 cm, this ratio decreased to 8%. Also, while the mass increased in older patients, the number of torsions had been decreased. In line with this, the number of torsions was higher in group I, while the mass size was larger in group II, and the differences were statistically significant. We think that the large size of the mass causes a decrease in the number of torsions by restricting the adnexa's movement in the pelvis. In the pathological evaluation, the most common results were serous cystadenoma. Mucinous cystadenoma in group II and mature cystic teratoma in group I. One of the reasons for the difference in the size of the torsioned mass between the groups may be the difference between these pathologic results because serous and mucinous cystadenomas as the size of mass are larger masses than mature cystic teratoma.

Literature shows us that there is a correlation between the length of ovarian ligaments and ovarian torsion [26]. Although some studies argue that routine ovariopexy should be performed in the conservative treatment of adnexal torsion [27, 28], since the effect of ovariopexy on fertility is not known, some authors oppose its routine administration [29]. The most common procedure is the laparoscopic fixation of the uteroovarian ligament with the suture or end loop method. In our study, ovarian fixation was performed in 25.3% of patients. Ovarian fixation to the sacrouterine ligament and uteroovarian fixation were preferred in most of these patients.

The patients who had malignant masses in group II are higher than group I. Malignant ovarian tumors invading the surrounding tissue and forming adhesions restrict the tissue's movement [30]. So this may have affected the low number of torsions in the adult group. There was a difference in numbers between the two groups in terms of malignancy detection but not statistically significant in our study. We think that this is due to the low number of malignant cases.

As the number of torsions increases, ischemia and necrosis speed increase due to a further decrease in blood supply [31]. Although detorsion is applied in such patients, radical surgery may be preferred because there is no return to healthy ovarian tissue. However, many studies reported that macroscopic appearance is not a good indicator for determining ovarian viability, and

adnexectomy should not be performed even if the ovarian tissue has not improved [8, 32-35]. In fact, in their studies, Oelsner and Cohen showed that the rates of completely recovering postoperative ovarian functions are 93-95% by following the ultrasonographic follicle development [14, 33, 34, 36]. They also stated that in the postoperative period of these patients, second-look laparoscopy could be performed in the presence of fever, leukocytosis, or peritoneal findings secondary to necrosis adnexectomy can be performed when necessary [14, 33]. In addition, it has been shown in an animal experimental study that the use of amlodipine can reduce tissue damage due to ischemia-reperfusion [37].

In conclusion, adnexal torsion can be encountered as a gynecological emergency in all age groups. Adnexal torsion should be considered in patients with abdominal pain, especially in the presence of a mass in the adnexa.

In these cases with non-specific clinical symptoms, rapid diagnosis and treatment can prevent irreversible adnexal damage. Due to the higher number of torsions in adolescent patients, the possibility of necrosis of the adnexes and irreversible damage increases. Therefore, considering the importance of fertility in adolescent patients, it is necessary to be faster and more careful in diagnosis and treatment.

As a surgical technique, laparoscopy should be the first choice since it is a minimally invasive procedure—no thromboembolic complications developed after conservative surgery. Conservative surgical treatment should be considered first in cases of torsion.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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Ethical approval

The study was approved by the Ethics Committee of the Dr Zekai Tahir Burak Woman's Health Education and Research Hospital (28 November 2013/5).

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