



## A Comparison of Laparotomy and Laparoscopic Surgery in the Treatment of Adnexal Torsion in the Reproductive Age Group at a Tertiary Care Hospital in Türkiye

Türkiye'de Tersiyer Bir Hastanede Üreme Çağı Grubunda Adneksiyal Torsiyon Tedavisinde Laparotomi ve Laparoskopik Cerrahinin Karşılaştırılması

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# A Comparison of Laparotomy and Laparoscopic Surgery in the Treatment of Adnexal Torsion in the Reproductive Age Group at a Tertiary Care Hospital in Türkiye

## ABSTRACT

**Objective:** To retrospectively evaluate the sociodemographic and clinical characteristics, and laboratory and pathology results of patients who underwent surgical intervention due to adnexal torsion in our clinic over the previous 10 years.

**Material and Method:** One hundred and seventy-six patients who underwent surgical procedures due to adnexal torsion, 146 of whom were treated with laparoscopy (L/S) (Group 1) and 30 with laparotomy (Group 2), between January 2014 and December 2023, were retrospectively and consecutively included in the study. The participants' sociodemographic and clinical characteristics, and laboratory and histopathology results were retrospectively recorded and compared.

**Results:** While no difference was observed between the groups in terms of age, body mass index, smoking status, alcohol use, gravidity, mass size, symptoms on admission, torsion turn number, the torsioned site, presence of necrosis, pre- and postoperative hemoglobin levels, white blood cell count, neutrophil, lymphocyte, monocyte, and platelet counts, red cell distribution width, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio, C-reactive protein, or erythrocyte sedimentation rate values, significant differences were determined in operative times ( $40.81 \pm 18.09$  in Group 1 vs  $82.33 \pm 18.03$  in Group 2,  $p < 0.001$ ) and hospitalization days ( $3.12 \pm 1.15$  in Group 1 vs  $4.33 \pm 1.54$  in Group 2,  $p = 0.002$ ). Detorsion + cystectomy was the most commonly performed surgical procedure, while mature cystic teratoma was the most frequently observed histopathological finding.

**Conclusion:** This study showed that L/S has a shorter operation time and hospital stay in surgical treatment of adnexal torsion in reproductive-age women. The results of this study should now be confirmed by research involving larger numbers of participants.

**Keywords:** Adnexial torsion, Clinical feature, Laparoscopy, Laparotomy.

## ÖZET

**Amaç:** Kliniğimizde son 10 yıl içinde adneksiya torsiyon nedeniyle cerrahi müdahale geçiren hastaların sosyodemografik ve klinik özelliklerini, laboratuvar ve patoloji sonuçlarını geriye dönük olarak değerlendirmek.

**Gereç ve Yöntem:** Ocak 2014 ile Aralık 2023 arasında adneksiya torsiyon nedeniyle cerrahi işlemler geçiren 176 hasta çalışmaya geriye dönük ve ardışık olarak dahil edilmiştir; bunlardan 146'sı laparoskopi (L/S) ile (Grup 1) ve 30'u laparotomi ile (Grup 2) tedavi edilmiştir. Katılımcıların sosyodemografik ve klinik özellikleri ile laboratuvar ve histopatoloji sonuçları geriye dönük olarak kaydedilmiş ve karşılaştırılmıştır.

**Bulgular:** Gruplar arasında yaş, vücut kitle indeksi, sigara durumu, alkol kullanımı, gravidite, kitle boyutu, başvuru sırasında semptomlar, torsiyone tur sayısı, torsiyone taraf, nekroz varlığı, preoperatif ve postoperatif hemoglobin seviyeleri, lökosit, nötrofil, lenfosit, monosit ve trombosit sayıları, kırmızı hücre dağılım genişliği, nötrofil-lenfosit oranı, trombosit-lenfosit oranı, C-reaktif protein veya eritrosit sedimentasyon hızı değerleri açısından herhangi bir fark gözlemlenmemiştir; ancak operasyon süresinde (Grup 1'de  $40.81 \pm 18.09$  vs Grup 2'de  $82.33 \pm 18.03$ ,  $p < 0.001$ ) ve hastanede yatış gününde (Grup 1'de  $3.12 \pm 1.15$  vs. Grup 2'de  $4.33 \pm 1.54$ ,  $p = 0.002$ ) anlamlı farklılıklar belirlenmiştir. Detorsiyon + kistektomi en sık gerçekleştirilen cerrahi prosedür olurken, olgun kistik teratom en sık gözlemlenen histopatolojik bulgudur.

**Sonuç:** Bu çalışma, L/S'nin üreme çağındaki adneksiya torsiyon cerrahisinde daha kısa operasyon ve hastanede yatış süresine sahip olduğunu göstermiştir. Bu çalışmanın sonuçları, daha fazla katılımcı içeren araştırmalarla doğrulanmalıdır.

**Anahtar Sözcükler:** Adneksiya torsiyon, Klinik özellik, Laparoskopi, Laparotomi

## Introduction

Adnexal torsion, which occurs due to the rotation of the ovary and/or fallopian tube around their vascular and ligamentous structures, accounts for approximately 3% of gynecological emergencies, and is the fifth most common of these. Although it can be seen in all age groups, it is most common during the reproductive years. If not diagnosed and treated in time, it can lead to adnexal loss and even death (1). Known risk factors include controlled ovarian stimulation, a history of adnexal torsion, polycystic ovary syndrome, tubal ligation, and pregnancy (2). Adnexal torsion is more commonly caused by follicular cysts, corpus luteum cysts, benign cystic teratomas, and cystadenomas. Endometriomas and malignant masses are less likely to cause torsion due to adhesions (3). Adnexal torsion is more commonly observed on the right side due to the lower mobility of the sigmoid colon, the greater mobility of the ileum and cecum, and the greater length of the right ligamentum ovarii proprium (4).

The most common symptom is acute onset of continuous or intermittent abdominal pain, while nausea-vomiting and fever may also be observed. In the event of adnexal torsion, venous blood flow is initially interrupted, leading to edema due to ongoing arterial flow, and eventually to complete cessation of arterial flow. If the necessary intervention is not performed, symptoms of peritonitis may also develop due to necrosis and inflammation (2). Acute appendicitis, pyelonephritis, ectopic pregnancy, pelvic inflammatory disease, cyst rupture, nephrolithiasis, and colitis should also be clinically differentiated in the diagnosis (3). A palpable pelvic mass in the lower genital region, rebound tenderness, and defense due to peritoneal irritation may be observed at physical examination (2).

Transvaginal ultrasonography (TVUSG) should represent the first-choice imaging option in the diagnosis of adnexal torsion. Important TVUSG findings include the presence of a mass, peripheral small follicles located centrally in the edema (a string of pearls), free fluid in the Douglas pouch, and the appearance of the follicular ring sign (whirlpool) (5). Blood flow may be observed in the early stages of Doppler ultrasound, while flow loss is seen in the later stages. Other diagnostic options include computed

tomography (CT) and magnetic resonance imaging (MRI) (6).

Laparoscopy is the preferred surgical procedure in the treatment of adnexal torsion due to such advantages as less postoperative pain, less blood loss, a rapid healing time, quicker return to daily activities, a shorter hospital stays, the avoidance of a large abdominal surgical incision, and reduced socioeconomic losses (3).

The type of surgical intervention should be personalized, taking into account the patient's age and fertility desires, and the appearance of the adnexal mass. Detorsion and aspiration of the cyst content or cystectomy represent conservative approaches, while oophorectomy or salpingo-oophorectomy are more invasive surgical options (2,3). The prevention of adnexal torsion by means of oophoropexy and shortening of the ligamentum ovarii proprium is controversial (3,5). This study retrospectively evaluated the sociodemographic and clinical characteristics, as well as the laboratory and pathology results, of patients who underwent surgical interventions for adnexal torsion in our clinic over the previous 10 years.

## Material and Method

This retrospective cohort study was conducted at the Antalya Training and Research Hospital Gynecology Unit, Türkiye, between January 2014 and December 2023. Ethics committee approval was obtained on 23.05.2024 under decision number 2024/145. The study was carried out in accordance with the principles of the Declaration of Helsinki, and no conflict of interest was declared by the authors. Written informed consent to the use of their data was obtained from the participants prior to hospitalization. Premenstrual and postmenopausal patients were excluded from the study, since premenstrual torsion cases in our hospital are evaluated by the pediatric surgery department and postmenopausal cases by the gynecological oncology department. A hundred and seventy-six patients underwent surgical procedures due to adnexal torsion during the study period, 146 of whom were treated with laparoscopy (Group 1), while 30 underwent laparotomy (Group 2).

Data were collected for age, body mass index (BMI) ( $\text{kg/m}^2$ ), smoking status, alcohol use, gravidity,

parity, mass size, symptoms on admission, torsion turn number, torsioned site, presence of necrosis, operative time, length of hospitalization, pre- and postoperative hemoglobin (Hb), white blood cell (WBC), neutrophil, lymphocyte, monocyte, and platelet counts, red cell distribution width (RDW), neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), C-reactive protein (CRP), and erythrocyte sedimentation rate (ESR) values on admission, surgical interventions applied, and pathological findings from hospital automation system and patient file archive. Ovarian stromal edema with or without peripherally displaced antral follicles, the follicular ring sign, the whirlpool sign, and absence of vascularization in the twisted organ are considered abnormal findings in adnexal torsion in USG and Doppler USG (5).

Sociodemographic and clinical characteristics, laboratory results, and surgical and pathological findings, were compared between the groups.

### Statistical analysis

Statistical analyses were performed using SPSS version 26.0 for Windows software (SPSS, Chicago, IL, USA). The Shapiro-Wilk test was used to examine continuous variables with normal and non-normal distributions, while Student's t-test was used to examine the normally distributed continuous variables. The Mann-Whitney U test was used for non-normally distributed continuous variables. Categorical data were analyzed using Pearson's chi-square test, while Fisher's exact test was applied if the expected frequency was less than five in >20% of all cells. Continuous variables were presented as mean  $\pm$  standard deviation (SD) or median (25th and 75th percentiles) and categorical variables as the number of cases and percentages. A  $p < 0.05$  value was regarded as statistically significant. In the post-hoc power analysis, the power of the study was found to be 92% with an effect size of 0.69 for operation time.

### Results

A comparison of the groups' sociodemographic and clinical characteristics is shown in Table I. No differences were observed between the groups in terms of age (24.74 $\pm$ 7.53 in Group 1 vs 23.73 $\pm$ 7.70 in Group 2,  $p=0.692$ ), BMI (27.81 $\pm$ 4.20 vs 26.20 $\pm$ 2.66,

$p=0.159$ ), smoking status (44 [30.1%] vs 12 [40.0%],  $p=0.455$ ), alcohol use (28 [19.2%] vs 6 [20.0%],  $p=0.941$ ), gravidity (1.0 [0-1.0] vs 0 [0-0],  $p=0.099$ ), parity (0 [0-0] vs 0 [0-0],  $p=0.426$ ), mass size (8.64 $\pm$ 2.66 vs 8.07 $\pm$ 2.51,  $p=0.651$ ), symptoms on admission (pelvic pain 142 [97.3%] vs 28 [93.3%],  $p=0.433$ ; pelvic mass 138 [94.5%] vs 26 [86.7%],  $p=0.270$ ; peritoneal signs 122 [83.6%] vs 20 [66.7%],  $p=0.156$ ; nausea/vomiting 100 [68.5%] vs 14 [46.7%],  $p=0.107$ ; fever 16 [11.0%] vs 4 [13.3%],  $p=0.677$ ; abnormal Doppler ultrasound findings 106 [72.6%] vs 18 [60.0%],  $p=0.330$ ), torsion turn number (2.27 $\pm$ 1.20 vs 2.47 $\pm$ 1.59,  $p=0.596$ ), the torsioned site (left 68 [46.6%] vs 14 [46.7%], right 78 [53.4%] vs 14 [46.7%], bilateral 0 [0%] vs 2 [6.7%],  $p=0.161$ ), or presence of necrosis (52 [35.6%] vs 12 [40.0%],  $p=0.748$ ). However, operative time (40.81 $\pm$ 18.09 minutes in Group 1 vs 82.33 $\pm$ 18.03 minutes in Group 2,  $p < 0.001$ ) and days of hospitalization (3.12 $\pm$ 1.15 days vs 4.33 $\pm$ 1.54 days,  $p=0.002$ ) differed significantly.

**Table I.** The Participants' Sociodemographic and Clinical Characteristics

		Laparoscopy (n=146)	Laparotomy (n=30)	p
<b>Age (years)</b>		24.74 $\pm$ 7.53	23.73 $\pm$ 7.70	0.692
<b>BMI (kg/m<sup>2</sup>)</b>		27.81 $\pm$ 4.20	26.20 $\pm$ 4.66	0.159
<b>Tobacco use (n, %)</b>		22 (30.1%)	6 (40.0%)	0.455
<b>Alcohol use (n, %)</b>		14 (19.2%)	3 (20.0%)	0.941
<b>Gravidity</b>		1 (0-1.0)	0 (0-0)	0.099
<b>Mass size (cm)</b>		8.64 $\pm$ 2.66	8.07 $\pm$ 2.51	0.651
<b>Symptoms (n, %)</b>	<b>Pelvic pain</b>	138 (94.5%)	26 (86.7%)	0.270
	<b>Pelvic mass</b>	142 (97.3%)	28 (93.31%)	0.433
	<b>Peritoneal signs (Rebound/Defense)</b>	132 (86.6%)	20 (66.7%)	0.156
	<b>Nausea/Vomiting</b>	100 (68.6%)	14 (46.7%)	0.107
	<b>Fever</b>	16 (11.0%)	4 (13.3%)	0.677
	<b>Abnormal Doppler ultrasound findings</b>	106 (72.6%)	18 (60.0%)	0.330
<b>Torsion turn number</b>		2.27 $\pm$ 1.20	2.47 $\pm$ 1.59	0.596
<b>The torsioned side (n, %)</b>	<b>Left</b>	<b>68 (46.6%)</b>	14 (46.7%)	0.161
	<b>Right</b>	<b>78 (53.4%)</b>	14 (46.7%)	
	<b>Bilateral</b>	0	2 (6.4%)	
<b>Presence of necrosis (n, %)</b>		26 (35.6%)	6 (40%)	0.748
<b>Operative time (min)</b>		40.81 $\pm$ 18.09	82.33 $\pm$ 18.03	<b>&lt;0.001*</b>
<b>Length of hospitalization (days)</b>		3.12 $\pm$ 1.15	4.33 $\pm$ 1.54	<b>0.002*</b>

BMI: body mass index, \*Statistically significant



The groups' laboratory outcomes are given in Table II. Preoperative (12.23±2.66 in Group 1 vs 11.61±2.39 in Group 2,  $p=0.177$ ) and postoperative Hb (10.73±2.38 vs 10.28±2.49,  $p=0.258$ ) levels, WBC (12.69±3.26 vs 12.14±3.37,  $p=0.631$ ), neutrophil (11.80±2.22 vs 12.28±2.44,  $p=0.452$ ), lymphocyte (1.51±0.33 vs 1.67±0.45,  $p=0.117$ ), monocyte (0.41±0.09 vs 0.45±0.12,  $p=0.213$ ), and platelet counts (222.42±59.65 vs 231.66±55.16,  $p=0.177$ ), and RDW (15.62±4.65 vs 14.78±2.04,  $p=0.273$ ), NLR (7.84±0.48 vs 7.49±0.82,  $p=0.131$ ), PLR (15.14±4.98 vs 19.20±5.65,  $p=0.101$ ), CRP (19.58±6.35 vs 19.06±6.21,  $p=0.868$ ), and ESR (42.57±12.86 vs 43.33±13.73,  $p=0.596$ ) values were comparable between the groups.

**Table II.** The Patients' Laboratory Outcomes

	Laparoscopy (n=146)	Laparotomy (n=30)	<i>p</i>
Preoperative Hb (g/dl)	12.23±2.66	11.61±2.39	0.177
Postoperative Hb (g/dl)	10.73±2.38	10.29±2.49	0.258
Leukocyte count (10 <sup>3</sup> ) (mcl)	12.69±3.26	12.14±3.37	0.631
Neutrophil count (10 <sup>3</sup> ) (mcl)	11.80±2.22	12.28±2.44	0.452
Lymphocyte count (10 <sup>3</sup> ) (mcl)	1.51±0.33	1.67±0.45	0.117
Monocyte count (10 <sup>3</sup> ) (mcl)	0.41±0.09	0.45±0.12	0.213
RDW	15.62±4.65	14.78±2.04	0.273
Platelet count (10 <sup>3</sup> ) (mcl)	222.42±59.65	231.66±55.16	0.177
NLR (%)	7.84±0.48	7.49±0.82	0.131
PLR (%)	15.14±4.98	19.20±5.65	0.101
CRP (mg/dL)	19.58±6.35	19.06±6.21	0.868
ESR (mm/h)	42.57±12.86	43.33±13.73	0.882

Hb: hemoglobin, Htc: hemotocrit, RDW: red cell distribution width, NLR: neutrophil/lymphocyte ratio, PLR: platelet/lymphocyte ratio, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate

Table III summarizes the patients' surgical intervention and pathological findings. No difference was determined between the groups in terms of surgical interventions performed (detorsion 46 [31.51%] vs 14 [46.7%], detorsion + cystectomy 82 [56.2%] vs 16 [53.3%], salpingo-oophorectomy 8 [5.5%] vs 0 [0%], hysterectomy + salpingo-oophorectomy 10 [6.8%] vs 0 [0%],  $p=0.114$ ) and pathological findings (serous cystadenoma 32 [21.9%] vs 4 [26.7%], mucinous cystadenoma 10 [6.8%] vs 1 [6.7%], hemorrhagic cyst 14 [9.6%] vs 1 [6.7%], mature cystic teratoma 44 [30.1%] vs 4 [26.7%], endometrioma 14 [9.6%] vs 1 [6.7%], borderline tumor 10 [6.8%] vs 1 [6.7%], corpus luteum cyst 8 [5.5%] vs 1 [6.7%])  $p=0.757$ .

4 [13.3%], corpus luteum cyst 8 [5.5%] vs 2 [6.7%], borderline tumor 10 [6.8%] vs 2 [6.7%], unclassified 14 [9.6%] vs 2 [6.7%])  $p=0.757$ .

**Table III.** A Comparison of the Patients' Surgical Intervention and Pathological Findings

		Laparoscopy (n=146)	Laparotomy (n=30)	<i>p</i>
Surgical intervention (n, %)	Detorsion	46 (31.5%)	14 (46.7%)	0.114
	Detorsion + Cystectomy	82 (56.2%)	16 (53.3%)	
	Salpingo- oophorectomy	8 (5.5%)	-	
	Hysterectomy + Salpingo- oophorectomy	10 (6.8%)	-	
Pathological findings (n, %)	Serous cystadenoma	32 (21.9%)	4 (26.7%)	0.757
	Mucinous cystadenoma	10 (6.8%)	1 (6.7%)	
	Hemorrhagic cyst	14 (9.6%)	1 (6.7%)	
	Mature cystic teratomas	44 (30.1%)	4 (26.7%)	
	Endometrioma	14 (9.6%)	1 (6.7%)	
	Borderline tumor	10 (6.8%)	1 (6.7%)	
	Corpus luteum cyst	8 (5.5%)	1 (6.7%)	

## Discussion

This retrospective study examined the sociodemographic and clinical characteristics and laboratory and pathology results of patients who underwent surgical interventions for adnexal torsion in our clinic over the previous 10 years. Analysis showed that patients undergoing laparoscopic surgery (L/S) had shorter operative times and lengths of hospitalization.

Adnexal torsion accounts for approximately 3% of gynecological surgical emergencies, and 70% of cases are seen in women of reproductive age. The condition is defined as a partial or complete rotation of the adnexal vascular pedicle and may involve the ovary, fallopian tube, or both. It is the fifth most common gynecological condition following ectopic pregnancy, corpus luteum rupture and bleeding, pelvic inflammatory disease, and acute appendicitis. In case of torsion, venous blood flow is initially disrupted, followed by impairment of arterial flow. Congestion, adnexal edema, ischemia, and ultimately necrosis develops as a result (2,3,7).

Elongation of the ligaments supporting the adnexa and the presence of a corpus luteum cyst increases the risk of adnexal torsion during pregnancy. Fifty-

five percent of cases of adnexal torsion during pregnancy occur in the first trimester, 34% in the second trimester, and 11% in the third (8). In the present study, five patients with adnexal torsion were in the first trimester, with four undergoing laparoscopic surgery (L/S) and one undergoing a laparotomic surgical procedure.

Although it can occur on both sides, adnexal torsion is typically observed more frequently on the right due to the longer right utero-ovarian ligament or the proximity of the left ovary to the sigmoid colon (9). In the present study, adnexal torsion was more frequently present on the right side, although this was not statistically significant. Adnexal torsion typically presents with acute, unilateral sharp pain (70%) or stabbing pain (60%) in the lower abdomen. Nausea and vomiting are observed in 60% to 70% of cases. Fever is usually seen in approximately 10% of cases, particularly in cases of necrosis. A palpable mass is found in approximately 60-90% of adults at physical examination, while in children the figure is 20-35%. Peritoneal irritation symptoms are observed in approximately 30% of cases (10). The most common symptoms in the current study were pelvic pain, pelvic mass, peritoneal signs, nausea/vomiting, and fever, with no statistically significant difference being observed between the L/S and laparotomy cases.

Ultrasound, with color Doppler if possible, should represent the preferred imaging modality for suspected adnexal torsion. The most commonly observed findings at ultrasound examination include an increased ovarian size and volume, and the absence of blood flow on Doppler ultrasound. The appearance of peripheral follicles ranging from 8 to 12 mm (whirlpool sign) in size due to ovarian congestion is moderately sensitive and highly specific for the diagnosis of adnexal torsion. Intraperitoneal fluid accumulation may be observed due to fluid leakage into the interstitial space (11). CT (with findings such as thickening of the uterine tube (74%), eccentric or concentric wall thickening (54%), and eccentric septal thickening (50%)) and MRI (with abnormal T1 and T2 images in the presence of hemorrhagic infarction) can also be used to detect adnexal torsion (12). In the present study, abnormal Doppler ultrasound findings were observed in 72.6% of the L/S group

and 60.0% of the laparotomy group, with a total incidence of 70.5% across the entire case group.

While specific histological findings such as ischemia, necrosis, and infarction are observed in 80% of torsioned adnexa, these findings may not be present in 20% (13). There is no specific laboratory test for the diagnosis of adnexal torsion. Serum WBC ( $>12 \times 10^9$ ) may be elevated in 56% of cases, and serum CRP levels rise in the presence of necrosis (13,14). Elevated WBC and CRP levels were observed in the present study.

The management of adnexal torsion has changed significantly over the past decade, with detorsion via laparoscopic surgical procedures, with or without cystectomy, despite the necrotic appearance of the ovary, being recommended (15). A previous study reported a shorter operative time, lower postoperative fever rates, and shorter hospital stays in a group of 179 patients with adnexal torsion treated with laparoscopic surgery (16). However, gynecologists with limited experience in laparoscopic surgery tend to prefer laparotomy. Oelsner et al. (17) observed fewer postoperative complications, and shorter hospital stays in cases of adnexal torsion treated with L/S. Cohen et al. retrospectively compared 102 cases of adnexal torsion treated with L/S and laparotomy. Those authors also concluded that L/S should constitute the primary approach for the definitive diagnosis and treatment of adnexal torsion, particularly in premenopausal patients (18). In the current study, the L/S group had shorter operative times ( $40.81 \pm 18.09$  min vs  $82.33 \pm 18.03$  min) and shorter lengths of hospitalization ( $3.12 \pm 1.15$  days vs  $4.33 \pm 1.54$  days). These findings were consistent with the literature.

The time elapsing from the onset of adnexal torsion to the surgical procedure has been shown to affect the management of the condition, longer delays being associated with a lower rate of adnexal salvage (19). In our clinic, patients hospitalized with suspected adnexal torsion undergo surgical interventions as soon as possible, within 24 hours of symptom onset.

Laparoscopic detorsion with or without cystectomy should represent the primary treatment method for both adults and children, in preference to salpingo-oophorectomy. This is because ovarian function has

been shown both histologically and biochemically to be preserved postoperatively (17,20). If the torsioned adnexa is excessively edematous, cystectomy may be delayed for 6-8 weeks, since it is highly sensitive to rupture (19).

In a previous study of 981 patients with adnexal torsion, 672 underwent detorsion and/or cystectomy, while 309 were managed conservatively. Pulmonary embolism was observed in only two of the entire patient group (21). No cases of thromboembolic events were observed in two large retrospective studies in which only detorsion was performed. This finding supports the conservative approach to managing adnexal torsion (17,18). In the present study, and consistent with the literature, no thromboembolic events were observed in any cases.

Malignancy has been detected in 3% of adult adnexal torsion cases. In postmenopausal patients, however, this can rise to 22%. Salpingo-oophorectomy is recommended in ovarian torsion occurring post-menopause (22). No malignancy was determined in any of the cases included in the present study, which were all in the premenopausal period. All our patients who underwent hysterectomy were in the perimenopausal period, and this surgical procedure was performed due to their own wishes and consent, with no evidence of malignancy found in any of them. However, it should be kept in mind that borderline tumors may be present in these patients.

Although adnexal torsion can occur without ovarian pathology, it is most commonly associated with benign ovarian cysts. The most frequently observed associated condition is mature cystic teratoma (2,3). The most commonly detected histopathological diagnosis (mature cystic teratoma) in the present study was consistent with the previous literature. The potential limitations of this study include its retrospective design and its being conducted at a tertiary center. However, one particular strength is that the surgical procedures were performed by two senior surgeons (BSI and HAI).

Adnexal torsion should be considered in cases presenting with acute abdominal pain and findings at Doppler ultrasound such as reduced or absent blood flow, along with increased adnexal size and volume. However, the decision to perform surgical intervention should not be based solely on ultrasound findings.

Rapid diagnosis and prompt surgical intervention can reduce the risk of trauma and ischemia to the ovary. Even in an adnexal structure that has acquired a blue-black color, detorsion should be performed first, and cystectomy only if necessary. Salpingo-oophorectomy should only be considered in postmenopausal women or in cases with an increased risk of malignancy. Oophoropexy can be considered in cases in which the adnexal ligament is congenitally long, in patients with recurrent torsion, or when no clear cause of torsion can be identified. In conclusion, laparoscopic surgical procedures should be preferred in adnexal torsion, especially for young reproductive-age patients who wish to preserve their fertility. The results of this study should now be confirmed by further research involving larger numbers of participants.

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