# ANATOLIAN
## CURRENT MEDICAL

# Adnexal torsion: a single-center retrospective study of diagnosis and treatment

Şeyma Osmanlıoğlu[1], Koray Görkem Saçıntı[2], Merve Aydın[2], Yavuz Emre Şükür[2]

[1]Department of Obstetrics and Gynecology, Faculty of Medicine, Ankara Medipol University, Ankara, Turkey
[2]Department of Obstetrics and Gynecology, Faculty of Medicine, Ankara University, Ankara, Turkey

## ABSTRACT

**Aims**: This study was conducted to review the clinical, laboratory, and ultrasound findings of patients with a confirmed post-operative adnexal torsion diagnosis in a tertiary university hospital and to reflect the management of adnexal torsion.

Methods: 44 patients (ages [15,44] with a median of 30 yr) who had an operation at Ankara University Hospital Gynecology and Obstetrics Clinics between October 2013 and February 2021 and in whom the preoperative diagnosis of adnexal torsion was confirmed intraoperatively were included in this retrospective study. Patients' complaints, existing risk factors, physical examination, laboratory, and radiological findings were evaluated.

**Results**: 26 (65%) of the patients complained about acute abdominal pain isolated on one side. Torsion was observed on the right side in 29 (66%) patients. Risk factors: History of ovarian torsion in 1 patient (2%), in vitro fertilization treatment in 5 (11%) patients, 4 (9%) of which also had ovarian hyperstimulation syndrome and 2 (5%) of them had polycystic ovary syndrome, and finally, 28 (65%) patients had increased ovarian size on ultrasound. Ovarian blood flow was not observed in 25 (81%) of 31 patients who underwent transvaginal Doppler ultrasound. Preoperative blood examination showed anemia (Hb<12 g/dL) in 14 (32%), leukocytosis (>10000/mm³) in 26 (59%), and an increase of neutrophil-lymphocyte ratio (NLR) (>3) in 36 (82%). Laparoscopy was performed in 37 (84%) patients and laparotomy in 7 (16%).

**Conclusion**: There is no objective diagnostic tool that can definitively lead to the diagnosis of adnexal torsion. It may be recommended to use ultrasound, Doppler, and NLR in addition to clinical findings and anamnesis. Considering the consequences of delay in the treatment, the most appropriate approach would be to perform a laparoscopy if torsion is suspected. Additionally, the patient's age, menopausal status, ovarian pathology, and desire for fertility are factors that should be considered in the treatment decision, and ovarian protection should be the primary goal.

**Keywords**: Adnexal torsion, laparoscopy, ovary, ultrasound, neutrophil-lymphocyte ratio

## INTRODUCTION

Adnexal torsion is caused by complete or partial rotation of the ovary and fallopian tube in the axis between the infundibulopelvic ligament and the utero-ovarian ligament, which can occur in women at any age but most often occurs in reproductive ages. It is one of the few gynecological surgical emergencies, and misdiagnosis or delays in treatment can result in peritonitis, ovarian loss, and even death. Since the diagnosis is made definitively only during surgery, the true incidence is unknown, and some patients may be misdiagnosed because they are not operated. However, the annual prevalence is about 2 to 6%,[1] and it is estimated that about 3% of patients admitted to the emergency department with acute abdominal pain have adnexal torsion.[2]

Common symptoms of adnexal torsion are pain, nausea, and vomiting with abdominal or pelvic pain, although symptoms may differ in premenarchic and pregnant patients. Imaging diagnostic tools, including Doppler analysis, magnetic resonance imaging, computed tomography, and laboratory findings, may be useful in diagnosis but should not overshadow clinical judgment. Normal Doppler flow can be seen in up to 60% of adnexal torsion cases.[3]

The main goal of treatment is to preserve ovarian function where detorsion is the recommended course of action to achieve this goal. Recent evidence indicates that normal ovarian function is restored after detorsion even in the presence of blue-black discoloration, so excision is only recommended when there is obvious gelatinous necrosis.[4,5]

Despite extensive research, preoperative diagnosis of adnexal torsion is challenging. This study was conducted to review the clinical, laboratory, and ultrasound (US) findings of patients with a confirmed post-operative adnexal torsion diagnosis in a tertiary university hospital and to reflect the management of adnexal torsion.

## METHODS

The study was initiated with the approval of the Ankara University Medical Faculty Clinical Researches Ethics Committee (Date: 10.05.2023, Decision No: İ04-274-23). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

In this retrospective study, patients who were operated at Ankara University Hospital Gynecology and Obstetrics Clinics between October 2013 and February 2021 and diagnosed intraoperatively with adnexal torsion were included. Women with a suspected diagnosis of torsion on ultrasound that are not confirmed by surgery and asymptomatic patients who underwent surgery for other reasons and were diagnosed intraoperatively with torsion were excluded from the study. Preoperatively, the diagnosis of adnexal torsion was made with or without sonographic concordance with clinical suspicion.

Data regarding patient age, infertility treatment, previous torsion episodes, clinical features, laboratory findings, preoperative pelvic ultrasound findings, transvaginal Doppler US examinations, course of the operation, and histological findings were obtained from electronic medical records and case files. An ultrasonographic evaluation was performed by gynecologists (resident/specialist physicians). Data were entered into an MS Excel spreadsheet and frequency and median values were calculated.

## RESULTS

Forty-four patients were included in the study who were operated and diagnosed with adnexal torsion. Nine of the cases (20%) occurred during pregnancy. The ages of the patients ranged from 15 to 44, with a median of 30 years.

While 26 (65%) patients presented with the complaint of acute abdominal pain isolated on one side, it was followed by widespread abdominal pain in four (13%) patients and inguinal pain in one (3%) patient. One of the patients complained of vomiting as well as abdominal pain.

As risk factors, history of ovarian torsion in 1 (2%) patient, in vitro fertilization (IVF) treatment in 5 (11%) patients, 4 (9%) of the patients with IVF treatment also had ovarian hyperstimulation syndrome (OHSS), in 2 (5%) patients polycystic ovary syndrome (PCOS), and in 28 (65%) patients an increase in ovarian size were observed on US. The median of cyst sizes ranging from 3.3 cm to 20 cm was calculated as 5.15 cm. Of the cysts seen, 10 (48%) were classified as simple, 8 (38%) hemorrhagic, 1 (5%) endometrioma, and 2 (10%) complex cysts. Two cysts, which were defined as complex cysts on ultrasound, were diagnosed as mature cystic teratoma after the pathological examination.

Free fluid was observed in 7 (16%) patients, hydrosalpinx was observed in 9 (20%) patients in the preoperative US, and the absence of ovarian blood flow was observed in 25 (81%) of 31 patients who underwent Doppler examination.

Anemia (Hb <12 g/dl) in 14 (32%) patients, leukocytosis (>10,000/mm³) in 26 (59%) patients, and increased neutrophil-to-lymphocyte ratio (NLR) (>3) in 36 (82%) patients were observed in blood tests before surgery.

Laparoscopy (L/S) was performed in 37 (84%) patients and Laparotomy (L/T) was performed in 7 (16%) patients. L/T was preferred due to pregnancy in two of the 7 patients, one had a 20 cm cyst on ultrasound, and the remaining four had a history of laparotomy. Torsion was observed on the right side in 29 (66%) patients and on the left side in 15 (34%) patients. Detorsion was performed in 42 (95%) patients, and cyst extirpation and detorsion were performed in 2 (5%) patients. Salpingoopherectomy was not performed in any patient. The median value for the operation time was 40 minutes, and the median value for the postoperative observation time was 2 days. No postoperative complications, including pulmonary embolism, were observed in any of the patients. Of the 9 patients who were operated during pregnancy, two underwent L/T and seven had L/S. Four of the pregnant women were in the first trimester, four were in the second trimester and one was in the third trimester. The two pregnant women who underwent laparotomy were in the 32nd and 15th weeks of pregnancy.

| Table 1. Laboratory and radiological findings in the study group | |
|---|---|
| **Preoperative Findings** | **Count (%)** |
| Initial symptom | |
|   Unilateral lower quadrant pain | 26 (84) |
|   Diffuse abdominal pain | 4 (13) |
|   Groin pain on the left | 1 (3) |
| Anemia (Hb<12 gr/dL) | 14 (32) |
| Leukocytosis (>10000/mm³) | 26 (59) |
| NLR (>3) | 36 (82) |
| Free fluid on US | 7 (16) |
| Hydrosalpinx on US | 9 (20) |
| Pathological Doppler flow | 25 (81) |
| NLR: Neutrophil-lymphocyte ratio; US: Ultrasound | |

| Table 2: Risk factors in cases with adnexal torsion | |
|---|---|
| | Count (%) |
| Pregnancy | 9 (20) |
| Infertility treatment | 5 (11) |
| PCOS | 2 (5) |
| Adnexal torsion history | 1 (2) |
| OHSS | 4 (9) |
| Increase in ovarian size on US | 28 (65) |
| Accompanying cyst on US | 21 (48) |
| Cyst Type | |
|   Simple | 10 (48) |
|   Hemorrhagic | 8 (38) |
|   Endometrioma | 1 (5) |
|   Complex | 2 (10) |
| Cyst Localization | |
|   Unilateral | 21 (100) |
|   Contralateral | 0 |
|   Bilateral | 0 |
| PCOS: Polycystic ovary syndrome; OHSS: Ovarian hyperstimulation syndrome; US: Ultrasound | |

| Table 3. Surgical procedures | |
|---|---|
| | Count (%) |
| Operation Type | |
|   Laparoscopy | 37 (84) |
|   Laparotomy | 7 (16) |
| Torsion localization | |
|   Right | 29 (66) |
|   Left | 15 (34) |
| Operation | |
|   Detorsion | 42 (95) |
|   Right/left salpingo-oophorectomy | 0 |
|   Cyst extirpation and Detorsion | 2 (5) |

## DISCUSSION

Torsion is usually associated with an ovarian cyst in women with moderately increased ovarian size. 46% of cases of torsion occur in normal-sized ovaries,[6,7] whereas it is less common in significantly enlarged ovaries. This is because enlarged ovaries tend to descend and prevent torsion. In our study, an increase in ovarian size was observed in 28 (65%) of 44 patients who underwent US. Three of the patients with an increase in ovarian size were treated with IVF and five were pregnant. Cysts associated with torsion commonly include corpus lutei, follicular cysts, cystadenomas, and benign cystic teratomas. Malignant lesions are relatively rare causes (approximately 2%) of torsion cases.[8] Our data also showed a similar picture, with 10 (48%) classified as simple, 8 (38%) as hemorrhagic, 1 (5%) as endometrioma, and 2 (10%) as complex cysts. Two cysts, defined on ultrasound as complex cysts, were diagnosed as mature cystic teratomas on pathologic examination.

Consistent with the literature,[2] our study showed a higher incidence of torsion cases in the right relative to the left ovary (66%-32%). An adnexal torsion on the right side

was seen in seven out of nine pregnant patients (about 78%). This is probably due to the proximity of the left ovary to the relatively stable sigmoid colon compared to the hypermobility of the right cecum and ileum.

History of adnexal torsion and tubal ligation, polycystic ovary syndrome, ovulation induction, ovarian hyperstimulation syndrome, and pregnancy have been shown as risk factors for adnexal torsion.[9] In our study, pregnancy was reported in 9 (20%) patients, infertility treatment in 5 (11%), PCOS in 2 (5%), torsion history in 1 (2%), and OHSS in four of the five patients who received IVF treatment.

A comprehensive medical history and physical examination are the two most important components of the diagnosis. Isolated acute abdominal pain (90-100%) on one side is the most common symptom in women with adnexal torsion.[3] This pain, resulting from occlusion of the vascular pedicle followed by hypoxia, can be described as constant or intermittent, as the ovary can torsion and detorsion over time, which can begin with a sudden change in position or activity. The venous and lymphatic systems are usually affected first because they are low-pressure systems.[10] In our study, 84% of patients had isolated abdominal pain, 13% had diffuse abdominal pain, and 3% had groin pain. In addition, one of the patients complaining of abdominal pain also complained of vomiting. Nausea (70%), vomiting (45%), fever (20%), and flank pain are among the symptoms reported in the literature.[6,7] If the torsion is prolonged, the adnexa may become necrotic or even infected, while the patient may show signs of peritonitis.[10] Findings on physical examination include normal body temperature to low-grade fever (18%),[7] mild tachycardia, and high blood pressure accompanying severe pain. Lower abdominal tenderness is usually unilateral but may spread to the side. However, in a broad retrospective study, up to 30% of patients reported a lack of pain on examination although confirmed later to have intraoperative torsion.[11]

Laboratory and imaging examinations can be used as diagnostic aids, but clinical assessment should not be overshadowed. Numerous studies have demonstrated how difficult it is to accurately diagnose adnexal torsion preoperatively since the symptoms and signs can be similar to several other diagnoses, and the diagnosis is confirmed laparoscopically in approximately 10% to 44% of patients.[1,12-14]

Ectopic pregnancy should be ruled out. Most laboratory findings are normal, although mild leukocytosis can be seen in 27% to 50% of patients.[6,7] The C-reactive protein (CRP) value and white blood cell count are usually lower than in acute appendicitis.[15] However, in one of our cases, in the 28th week of pregnancy with a CRP level of 21.8 mg/l, appendicitis could not be ruled

out preoperatively. In case of doubt, general surgical consultation is recommended. Mild leukocytosis and anemia were observed in 59% of the patients in our study, and NLR was increased in 82% of the patients. In a retrospective study, it was shown that NLR is increased in torsion patients.[16] In this study where patients with surgically proven torsion were compared with patients who were operated for non-malignant ovarian masses, the sensitivity of NLR was calculated as 88.9% and the specificity as 100%.

Pelvic ultrasonography with or without Doppler analysis is the most frequently used imaging tool in adnexal torsion diagnosis. Common findings of pelvic ultrasonography include unilateral ovarian enlargement, ovarian mass, uniform peripheral cystic structures, and free fluid in the Douglas.[15] Consistent with the literature in our study, free fluid was observed in 16% of patients, hydrosalpinx in 20%, unilateral ovarian enlargement in 65%, and cystic structures in 48% of patients.

There are conflicting views in the literature on the use of color Doppler analysis. In a retrospective study of intraoperatively proven cases of adnexal torsion, it was shown that the absence of venous Doppler flow had a high positive predictive value of 94% for ovarian torsion.[7] However, it was shown that arterial Doppler flow was maintained in up to 60% of patients with torsion.[2,7,17] In our study, the pathological flow was observed in 81% of the patients who underwent Doppler, which might be used as a good diagnostic tool according to our results.

Adnexal torsion is a gynecologic emergency, and the most common treatment is laparoscopic detorsion of the adnexa. Most cases of torsion were managed by adnexectomy, as it was previously thought that detorsion in adnexal torsion could cause a vascular embolism.[10] However, this has proven to be untrue. In a review of more than 1000 cases of torsion, McGovern et al.[18] showed a 0.2% risk of pulmonary embolism in cases both with and without adnexal detorsion.[6] Even if the ovary appears macroscopically black-blue intraoperatively, most (90%) ovaries show normal appearance in second look operation with normal follicular development on ultrasound, and normal Doppler flow, after only 6 weeks.[3] In our study, L/S was performed in 37 (84%) patients and L/T was performed in 7 (16%) patients. Detorsion was performed in all patients, as recommended in the literature, and salpingo-oophorectomy was not performed in any of the patients. The median value for the operation time was 40 minutes, and the median value for the postoperative observation time was 2 days. No postoperative complications, including pulmonary embolism, were observed in any of the patients, supporting the laparoscopic detorsion as the best therapy option.

Maintaining ovarian protection as the primary goal, patient's age, menopausal status, ovarian pathology, and desire for fertility are factors that should be considered in the treatment decision. There are two options for treatment, conservative and definitive. Conservative treatment corresponds to detorsion of the adnexa and aspiration of associated cysts or opening and removing associated cysts. Since torsion causes edema, some authors recommend only detorsion of the adnexa and postoperative follow-up with ultrasonography to determine if cystectomy is necessary.[3] Due to the loss of tissue layers, a cystectomy can be challenging. On the other hand, if the cyst is not removed, there is a risk of retorsion and additional surgical intervention.

Definitive treatment includes salpingectomy and/or oophorectomy. In decision-making, the time from the onset of pain to surgery has been suggested as a marker of necrosis, rather than ovarian appearance, although this time varies across studies.[3] Although malignancy-related torsion is uncommon (2% of torsion cases), this possibility should also be considered in decision-making.[3]

It has been reported in the literature that up to 25% of cases of torsion occur during pregnancy.[3] In our study, 20% (9) of the patients were pregnant. Most cases of torsion were reported in the first or second trimester and only 5% were observed after 20 weeks of gestation. The most common pathological conditions are mature cystic teratomas, followed by corpus lutei and para tubal cysts, respectively.[3] In our study, mature cystic teratoma was diagnosed in two pregnant women. Ultrasound may not show the same findings as torsion in a non-pregnant patient. As the follicle-stroma ratio increases in multifollicular ovaries, the edematous appearance of the stroma may be absent, and the ovaries may be characterized as normal.[19] Also, as pregnancy progresses, the ovaries become harder to visualize. Torsion treatment for the pregnant is the same as for non-pregnant patients. In our study, L/S was applied to seven of nine pregnant women and no complications were observed in the postoperative follow-up. In the operating room, especially in the third trimester, the patient should be tilted to the left to avoid compression of the inferior vena cava. Laparoscopy can be performed in all trimesters,[20] and all access methods can be used. For optimal visualization, it is recommended to stay a few centimeters above the fundus. The pregnant woman should be informed about the risk of premature birth, miscarriage, and premature rupture of membranes. The benefits of laparoscopy is similar in pregnant and non-pregnant patients.[3] In the case of surgery in the first trimester, the administration of supplemental progesterone is recommended, so all our patients received progesterone in the first semester.

A patient with an early pregnancy (only gestational sac was visible on preoperative ultrasound) suffered from miscarriage after the surgery.

## CONCLUSION

In summary, it may be recommended that in addition to clinical findings, medical history, transvaginal ultrasound and Doppler, the neutrophil-to-lymphocyte ratio can be used as an additional marker in the diagnosis. Considering the consequences of delay in the treatment of adnexal torsion, the most appropriate approach would be to perform a laparoscopy if torsion is suspected. A laparoscopy can be performed in all trimesters. Supplemental progesterone in the first trimester is recommended. Maintaining ovarian protection as the primary goal, patient's age, fertility desire, menopausal status, and ovarian pathologies are factors to be considered in the management decision.

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** The study was initiated with the approval of the Ankara University Medical Faculty Clinical Researches Ethics Committee (Date: 10.05.2023, Decision No: İ04-274-23).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent  form was obtained from patients.

**Referee Evaluation Process:** Externally peer-reviewed.

**Conflict of Interest Statement:** The authors have no conflicts of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

**Author Contributions:** All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version.

## REFERENCES

1. Anteby S, Schenker J, Polishuk W. The value of laparoscopy in acute pelvic pain. *Ann Surg.* 1975;181:484-486.

2. Lentz G, Lobo R, Gershenson D. Comprehensive gynecology. 6th ed. Philadelphia, PA: Mosby, Inc. p.383-432;2012.

3. Sasaki KJ, Miller CE. Adnexal torsion: review of the literature. *J Minim Invasive Gynecol.* 2014;21:196-202.

4. Oelsner G, Bider D, Goldenberg M, Admon D, Mashiach S. Long-term follow-up of the twisted ischemic adnexa managed by detorsion. *Fertil Steril.* 1993;60(6):976-979.

5. Huchon C, Fauconnier A. Adnexal torsion: a literature review. *Eur J Obstet Gynecol Reprod Biol.* 2010;150:8-12.

6. Pansky M, Smorgick N, Herman A, Schneider D, Halperin R. Torsion of normal adnexa in postmenarchal women and risk of recurrence. *Obstet Gynecol.* 2007;109:355-359.

7. Shadinger LL, Andreotti RF, Kurian RL. Preoperative sonographic and clinical characteristics as predictors of ovarian torsion. *J Ultrasound Med.* 2008;27(1):7-13.

8. Oltmann SC, Fischer A, Barber R, Huang R, Hicks B, Garcia N. Cannot exclude torsion-a 15-year review. *J Pediatr Surg.* 2009;44:1212-1217.

9. Boswell K, Silverberg K. Recurrence of ovarian torsion in a multiple pregnancy:conservative management via transabdominal ultrasound-guided ovarian cyst aspiration. *Fertil Steril.* 2010;94:1-3.

10. Nichols D, Julian P. Torsion of the adnexa. *Clin Obstet Gynecol.* 1985;28:375-380.

11. Houry D, Abbott JT. Ovarian torsion: a fifteen-year review. *Ann Emerg Med.* 2001;38(2):156-159.

12. Cohen S, Weisz B, Seidman D, Mashiach S, Lidor A. Accuracy of the preoperative diagnosis in 100 emergency laparoscopies performed due to acute abdomen in nonpregnant women. *J Am Assoc Gynecol Laparosc.* 2001;8(1):92-94.

13. Haskins T, Shull B. Adnexal torsion:a mind-twisting diagnosis. *South Med J.* 1986;79(5):576-577.

14. Bar-On S, Mashiach R, Stockheim D,  et al. Emergency laparoscopy for suspected ovarian torsion:are we too hasty to operate? *Fertil Steril.* 2010;93(6):2012-2015.

15. Chang HC, Bhatt S, Dogra VS. Pearls and pitfalls in diagnosis of ovarian torsion. *Radiographics.* 2008;28(5):1355-1368.

16. Ercan Ö, Köstü B, Bakacak M, Coşkun B, Tohma A, Mavigök E. Neutrophil to Lymphocyte ratio in the diagnosis of adnexal torsion. *Int J Clin Exp Med.* 2015;8(9):16095-16100.

17. Peña JE, Ufberg D, Cooney N, Denis AL. Usefulness of Doppler sonography in the diagnosis of ovarian torsion. *Fertil Steril.* 2000;73(5):1047-1050.

18. McGovern PG, Noah R, Koenigsberg R, Little AB. Adnexal torsion and pulmonary embolism: case report and review of the literature. *Obstet Gynecol Surv.* 1999;54(9):601-608.

19. Djavadian D, Braendle W, Jaenicke F. Laparoscopic oophoropexy for the treatment of recurrent torsion of the adnexa in pregnancy: case report and review. *Fertil Steril.* 2004;82(4):933-936.

20. Chohan L, Kilpatrick CC. Laparoscopy in pregnancy: a literature review. *Clin Obstet Gynecol.* 2009;52(4):557-569.