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ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2026;15(3):1113-7

Computed tomography imaging features of surgically confirmed ovarian torsion: A retrospective analysis

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Received 18 June 2025; Accepted 04 September 2025
Available online 11 August 2026 with doi: 10.5455/medscience.2025.06.164

Abstract

To evaluate preoperative computed tomography (CT) findings in surgically confirmed ovarian torsion and assess the diagnostic value of key imaging features. This retrospective study included 25 patients (26 torsed ovaries) with confirmed ovarian torsion and available preoperative contrast-enhanced pelvic CT. Images were reviewed by an experienced abdominal radiologist blinded to surgical results. CT features assessed included ovarian size, pedicle thickness, whirlpool sign, adnexal position, uterine deviation, tubal changes, and pelvic free fluid. Statistical analysis included t-tests, logistic regression, and ROC analysis. Torsed ovaries showed significantly greater pedicle thickness (mean: 12.2 ± 3.5 mm) and size (mean: 55.4 ± 15.2 mm) compared to contralateral ovaries ($p < 0.001$). A combined model of pedicle thickness and ovarian size demonstrated excellent diagnostic performance (AUC: 0.963). Uterine deviation was present in 64% of cases, abnormal ovary position in 88%, whirlpool sign in 58%, and pelvic free fluid in 92%. Optimal thresholds were > 12 mm for pedicle thickness and > 45 mm for ovarian size. On emergency CT, the combination of ovarian enlargement and thickened or twisted pedicle is highly predictive of torsion. Secondary signs such as uterine deviation, whirlpool sign, and pelvic fluid further strengthen the diagnosis. Recognizing these findings may enable earlier detection and timely surgical management. Larger prospective studies are needed to validate these CT indicators in broader clinical settings.

Keywords: Ovarian torsion, computed tomography, ovary

Introduction

Ovarian torsion is a gynecological emergency characterized by rotation of the ovary around its pedicle, leading to impaired vascularization of the ovarian parenchyma and subsequent ischemia. Typically, ovarian torsion is accompanied by torsion of the fallopian tube and adnexal ligaments [1,2]. Although ovarian torsion can occur at any age, it most commonly affects women of reproductive age; however, cases have also been reported in premenarchal girls and postmenopausal women. The presence of an ovarian mass or cyst is the most significant risk factor for developing torsion; ovarian cysts have been reported to occur three times more frequently in torsion cases compared to the general population [3,4].

Ovarian torsion often presents with sudden-onset, severe lower abdominal pain but lacks specific clinical signs, frequently mimicking conditions like appendicitis or pelvic inflammatory disease. This can lead to delayed diagnosis, which significantly reduces the chance of ovarian salvage [5]. Early recognition and prompt surgical detorsion are critical to prevent irreversible ischemic damage. Ultrasound (US) with color Doppler is the first-line imaging tool, typically showing an enlarged ovary with peripherally displaced follicles and decreased or absent hilar flow. However, Doppler findings may be misleading—normal arterial flow can persist in early torsion. Studies report normal Doppler flow in up to 61% of right-sided and 27% of left-sided torsion cases [6].

With the widespread use of computed tomography (CT) in emergency departments, ovarian torsion is increasingly detected incidentally on scans performed for other suspected conditions such as appendicitis or urolithiasis. While MRI findings of torsion are well documented, CT-based descriptions remain limited [7,8]. Given CT's practical role in acute settings, recognizing its diagnostic features is essential for timely intervention. This study aims to evaluate preoperative CT findings in surgically confirmed ovarian torsion cases, raise radiologist awareness, and assess the diagnostic value of CT in the context of current literature.

CITATION
Akcay A. Computed tomography imaging features of surgically confirmed ovarian torsion: A retrospective analysis. Med Science. 2026;15(3):1113-7.

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DOI: 10.5455/medscience.2025.06.164

Material and Methods

Between 2011 and 2025, 35 patients who underwent surgery for ovarian torsion and had intraoperative confirmation of the diagnosis in our hospital's gynecology and obstetrics departments were retrospectively reviewed. Ten patients without available preoperative CT imaging were excluded. Inclusion criteria were: (1) documentation of adnexal torsion in the surgical report, (2) preoperative pelvic CT performed at our institution, and (3) archived CT images of adequate quality for evaluation. Demographic data and surgical notes were retrieved from electronic medical records. Institutional ethics committee approval was obtained, and patient confidentiality was maintained throughout the study (Bezmialem Vakıf University / 26.05.2025/ E-54022451-050.04-194684).

CT Protocol and Image Analysis

All CT examinations were performed using a multidetector computed tomography (MDCT) scanner under contrast-enhanced abdominal/pelvic CT protocols. In the majority of cases, 80–100 mL of iodinated contrast agent was administered intravenously, and portal venous phase images were obtained. The slice thickness was typically 3–5 mm, and multiplanar reconstructions were reviewed on a picture archiving and communication system (PACS) workstation. All images were evaluated retrospectively by an abdominal radiologist with five years of experience, who was blinded to clinical and surgical outcomes.

The maximum diameter of the torsed ovary was measured in millimeters, and the contralateral ovary was also measured for comparison (Figure 1). The thickness of the vascular pedicle, including the mesovarium and tubo-ovarian attachments, was measured at its thickest point on the torsed side, with a corresponding measurement on the unaffected side for comparison. Independently of pedicle thickness, the presence of the "whirlpool sign" was assessed by evaluating axial and coronal images for a twisted or spiral configuration of the vascular pedicle [9].

Adnexal malposition was defined as displacement of the ovary from its expected anatomical location, particularly when located over the uterus or in the contralateral hemipelvis (Figure 2). Ovarian position was categorized as normal, midline, or contralateral. Uterine deviation was assessed by examining whether the uterine corpus was pulled toward the torsed side; if a distinct lateral deviation toward the affected side was observed, it was recorded as present. The appearance of the fallopian tube on the torsed side was also evaluated, and if it appeared edematous, thickened, or twisted compared to the contralateral side, it was considered abnormal [10].

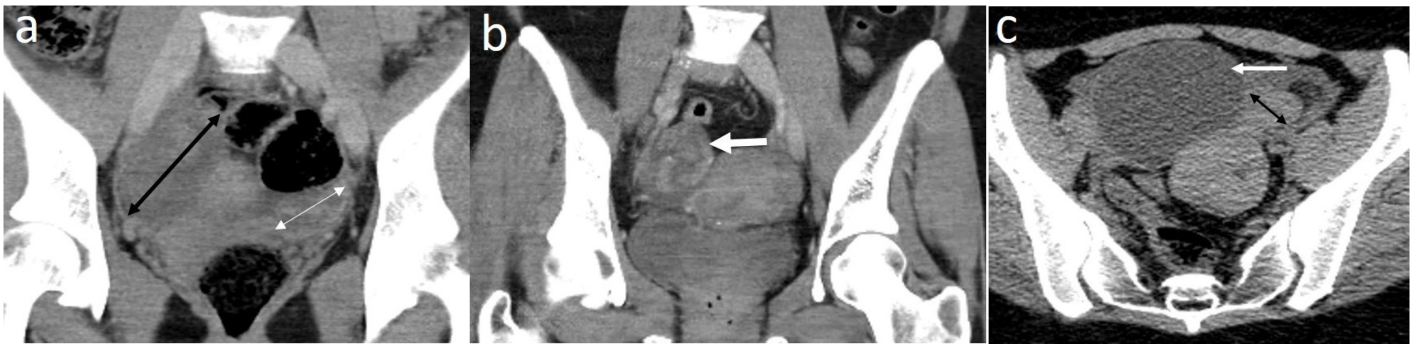

Figure 1. a) Coronal pelvic CT image shows ovarian size measurements; The torsed right ovary (black arrow) is enlarged compared to the non-torsed left ovary (white arrow); **b)** Coronal image shows twisting of vascular structures in the right ovarian pedicle, consistent with the whirlpool sign (arrow); **c)** Axial image shows thickening of the left ovarian pedicle (black arrow) and displacement of the torsed ovary across the midline into the contralateral hemipelvis (white arrow)

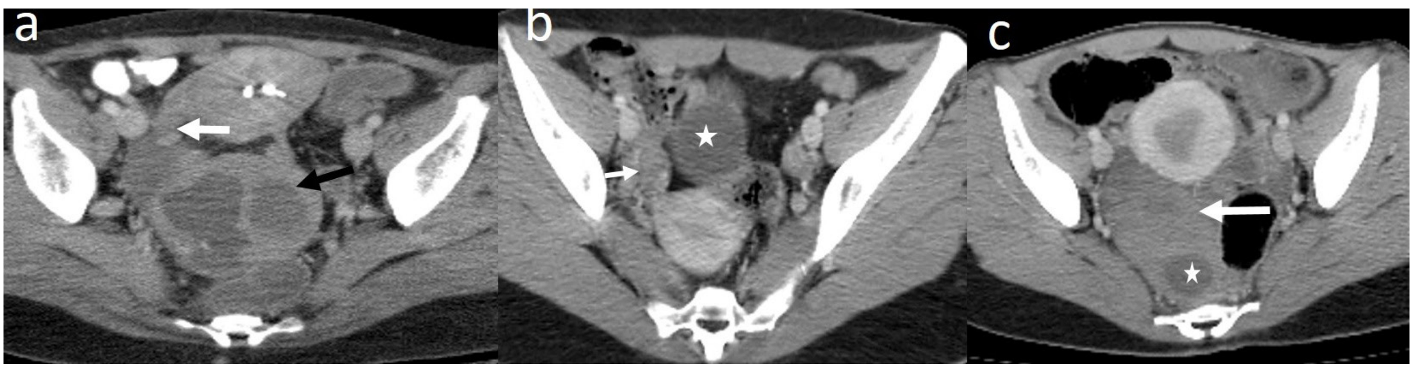

Figure 2. a) Axial pelvic CT image shows a multilocular cystic mass causing torsion (black arrow), with the right ovary displaced to the midline behind the uterus; Thickening of the ovarian pedicle and uterine deviation toward the torsion side are seen (white arrow); **b)** Axial image shows pedicle thickening (white arrow) and anterior midline displacement of the torsed right ovary (star); **c)** Axial image shows the enlarged torsed ovary (white arrow) in the midline, posterior to the uterus, with a cystic lesion (star)

DOI: 10.5455/medscience.2025.06.164

Additionally, the presence of free fluid in the pelvis was recorded. Any cystic or solid lesion identified within or adjacent to the torsed ovary was noted, and its maximum diameter was measured.

Statistical Analysis

All statistical processing was carried out in IBM SPSS Statistics, version 26 (IBM Corp., Armonk, NY). The Shapiro–Wilk test was used to evaluate distributional normality. Normally distributed variables are summarised as mean ± standard deviation (SD); skewed variables are given as median and inter-quartile range (IQR). Group comparisons employed the independent-samples t test for parametric data and the Mann–Whitney U test for non-parametric data. Categorical results are expressed as counts and percentages, and differences were examined with the χ^2 test or Fisher exact test. Predictors of torsion were explored using binary logistic regression. Model discrimination was assessed with the area under the receiver-operating-characteristic curve (AUC) and its 95% confidence interval (CI). The Youden index identified the optimal diagnostic thresholds. Statistical significance was defined as a two-tailed $p < 0.05$.

Result

A total of 25 patients were included in the study, with one case of bilateral ovarian torsion, resulting in the evaluation of 26 torsed ovaries and 24 contralateral non-torsed ovaries. The mean age of the patients was 32.0 ± 12.8 years (median: 29, range: 17–60 years).

An associated ovarian lesion was identified in 80.7% (21/26) of the torsed ovaries, with a mean lesion diameter of 87 ± 48 mm (range: 28–180 mm). Tubal thickening was observed in 69.2% (18/26) of torsed ovaries compared to the contralateral side.

Pedicle thickness was significantly greater in torsed ovaries, with a mean of 12.2 ± 3.5 mm (median = 12; IQR = 10.3–14.0), compared to 7.1 ± 2.3 mm (median = 7; IQR = 5.0–8.3) in non-torsed ovaries ($p < 0.001$). Ovarian size was also significantly larger in the torsed group (mean: 55.4 ± 15.2 mm; median = 56; IQR = 45.3–66.8) than in the contralateral non-torsed ovaries (mean:35.4 ± 8.1 mm; median = 37; IQR = 33.0–40.0) ($p < 0.001$). All quantitative CT measurements are detailed in Table 1.

Table 1. CT findings in torsed versus contralateral non torsed ovaries

Imaging finding	Torsed ovaries (n = 26)	Contralateral ovaries (n = 24)	p value
Pedicle thickness, mm — mean ± SD (median; IQR)	12.2 ± 3.5 (12;10.3–14.0)	7.1 ± 2.3 (7;5.0–8.3)	< 0.001
Ovarian size, mm — mean ± SD (median; IQR)	55.4 ± 15.2 (56;45.3–66.8)	35.4 ± 8.1 (37;33.0–40.0)	< 0.001
Associated ovarian lesion, n (%)	21 (80.7)	—	—
Tubal thickening, n (%)	18 (69.2)	—	—
Whirlpool sign, n (%)	15 (57.6)	—	—
Uterine deviation toward torsion, n/total (%)	16/25 (64.0)	—	—
Pelvic free fluid, n/total (%)	23/25 (92.0)	—	—
Ovary position — normal / midline / contralateral, n	3/19/4	—	—

Regarding anatomical location, 11.5% (n = 3) of torsed ovaries remained in normal position, 73% (n = 19) were located in the midline over the uterus, and 15.3% (n = 4) were displaced to the contralateral hemipelvis. The whirlpool sign was identified in 57.6% (15/26) of cases. Uterine deviation toward the torsion side was present in 64.0% (16/25) of patients. Pelvic free fluid was noted in 92% (23/25) of cases. The prevalence of key CT findings is summarised in Figure 3.

A bivariate model including pedicle thickness and ovarian size yielded an excellent diagnostic performance for torsion, with an area under the receiver-operating-characteristic curve (ROC-AUC) of 0.963 (95% CI: 0.91–1.00; $p < 0.001$). Regression analysis showed pedicle thickness as a stronger predictor (OR = 1.90; 95% CI: 1.23–2.93; $p = 0.004$), followed by ovarian size (OR = 1.20; 95% CI:1.06–1.37; $p = 0.005$). Optimal cut-off values maximizing the Youden index were 12 mm for pedicle thickness (sensitivity 0.68, specificity 0.96, AUC 0.89) and 45 mm for ovarian size (sensitivity 0.76, specificity 0.92, AUC 0.87). Both parameters showed moderate positive correlation with torsion ($r = 0.66$ and $r = 0.63$, respectively; $p < 0.001$ for both).

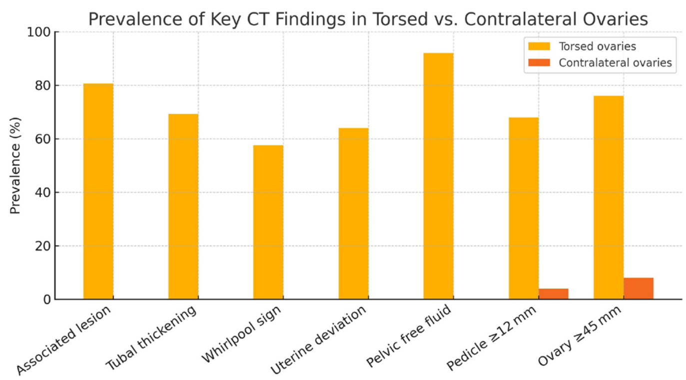

Figure 3. Prevalence of principal CT findings in torsed (red bars) versus contralateral non-torsed ovaries (blue bars); Data are expressed as percentages of ovaries exhibiting each feature

 DOI: 10.5455/medscience.2025.06.164

Discussion

In this study, CT findings of 25 patients who underwent surgery for ovarian torsion were evaluated, and ovarian enlargement as well as a thickened or twisted ovarian pedicle were identified as key diagnostic features, consistent with the existing literature [11]. CT-based analysis showed that a pedicle diameter>12mm combined with an ovarian size > 45mm identifies torsion with excellent accuracy (ROC-AUC = 0.963). While earlier studies used a 5 cm ovarian cut-off, adding pedicle thickness greatly improves discrimination [12]. Practically, any bridging tissue wider than 1 cm between the ovary and uterine cornua on CT should trigger strong suspicion of torsion, consistent with the "inter-utero-ovarian mass" sign described by Mandoul et al [13]. Together, these two objective measurements offer a simple, reliable model for diagnosing ovarian torsion on CT. Although detecting the twisted pedicle sign is generally more difficult on CT than MRI, we observed it in over half of our cases—higher than previously reported rates. This may be due to improved image quality and the use of multiplanar reconstructions, which make the twisting more visible [14].

Roughly 75 % of our torsion cases contained an ovarian cyst or other mass, consistent with earlier studies showing that adnexal torsion often coexists with an ovarian lesion [14]. A mass alone is not specific, however—similar findings can appear in the opposite ovary or in patients without torsion. Therefore, when a mass is seen on CT, torsion should be suspected but confirmed with additional signs such as a thickened pedicle or a whirlpool twist. One such supportive feature is tubal thickening; however, this finding is also nonspecific. Importantly, tubal thickening is likewise nonspecific: pelvic inflammatory disease can create dilated, edematous tubes, and—as noted by Lee et al. —isolated tubal thickening is insufficient evidence of torsion [14]. In our series, tubal edema always appeared alongside other torsion signs (enlarged ovary, thickened pedicle), serving only as a supportive feature.

Uterine deviation toward the torsion side was seen in 64% of cases, likely due to traction on the utero-ovarian ligament. It is a recognized secondary CT sign of torsion15. However, similar deviation can occur with large ovarian masses without torsion, with reported false-positive rates of 14–16% [14]. Diagnostic value increases when seen with a thickened pedicle and malpositioned ovary. Our rate exceeds prior meta-analyses (~37%), likely due to focused retrospective review [11]. Overall, it is a helpful but nonspecific sign. Torsion often displaces the ovary from its normal lateral position. In our study, most torsed ovaries were shifted medially or posteriorly, consistent with prior reports. Meta-analyses report abnormal ovary location in approximately 69% of cases, while Rathi et al. found 77% in a midline position on CT [11,15]. This displacement can be a helpful sign, especially when the ovary is enlarged. However, identifying ovarian tissue on CT may be challenging without careful inspection. Coronal or sagittal reformats and awareness of normal landmarks improve detection. Overall, abnormal ovary location is a common and supportive CT feature of torsion. Free fluid was seen in 80–90% of torsion cases, often reflecting venous congestion or hemorrhage. It was more common in prolonged torsion or necrosis. Though nonspecific, it gains value when combined with other findings. Our findings are consistent with previous literature [11].

Our study has some limitations. It is a small, single-centre, retrospective series, which restricts generalisability and introduces selection bias. Image review was performed with knowledge of surgical findings, so reader bias is possible and inter-observer agreement was not measured. Finally, the threshold values derived from our cohort require prospective validation across other scanners, protocols and larger multi-institutional data sets.

Conclusion

Ovarian torsion should be strongly suspected on emergency CT when an enlarged ovary is seen with a thickened or twisted pedicle. This combination was highly accurate in our study. Additional signs such as uterine deviation, whirlpool sign, or pelvic fluid can further support the diagnosis. Awareness of these findings can improve early detection and prompt surgical intervention. Larger prospective studies are needed to confirm their diagnostic value.

Ethical Approval

The study was approved by the Bezmialem Vakıf University Scientific Research Ethics Committee (No: 2025/115; Date: 14 May 2025).

Patient Consent

Informed consent was waived by the ethics committee due to the retrospective design.

Conflict of Interest

The authors declare no conflict of interest.

Funding

No financial support was received.

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