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Adnexal Torsion: Diagnostic Challenges and Ovarian Preservation in a Narrative Review.

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ABSTRACT

Adnexal torsion is a gynecologic surgical emergency that can lead to ovarian ischemia and necrosis if diagnosis and treatment are delayed. Diagnosis remains challenging because clinical manifestations are variable and nonspecific, while ultrasonographic findings, including preserved blood flow on Doppler ultrasonography, do not reliably exclude torsion. This narrative review aims to describe the clinical manifestations and risk factors of adnexal torsion, identify factors contributing to misdiagnosis, and evaluate the diagnostic accuracy of clinical, laboratory, and imaging assessments to facilitate early diagnosis and ovarian preservation. Typical manifestations include abdominal or pelvic pain accompanied by nausea and vomiting, although symptoms may be intermittent, develop gradually, or mimic other acute abdominal conditions. Clinical presentations may also differ among pediatric, pregnant, perimenopausal, and postmenopausal patients. Misdiagnosis may result from limitations in ultrasonographic assessment, overlapping clinical features with other conditions, and cognitive biases, including anchoring, framing effects, premature closure, and availability bias. Ultrasonography remains the first-line imaging modality, although the diagnostic sensitivity of individual sonographic findings varies. Contrast-enhanced ultrasonography and laboratory markers, particularly the neutrophil-to-lymphocyte ratio, may provide additional diagnostic information. Predictive models integrating clinical symptoms, ultrasonographic findings, and inflammatory markers may further improve diagnostic assessment. Surgical management prioritizes prompt detorsion and ovarian preservation, as intraoperative ovarian discoloration or edema does not necessarily indicate irreversible tissue necrosis. Early recognition and timely intervention require an integrated assessment of clinical manifestations, laboratory findings, and imaging results to optimize ovarian preservation and reproductive outcomes.

INTRODUCTION

Adnexal torsion is a gynecologic surgical emergency resulting from the complete or partial rotation of the ovary, fallopian tube, or both around the axis of their supporting ligaments (Bridwell et al., 2022). This rotation initially obstructs venous and lymphatic drainage, followed by impaired arterial perfusion, potentially leading to ovarian ischemia and

tissue necrosis (Dawood et al., 2021). Adnexal torsion is estimated to account for approximately 2%–3% of gynecologic emergencies (Dawood et al., 2021).

The primary challenge in managing adnexal torsion is its variable and nonspecific clinical presentation (Kives et al., 2017). The most frequently reported symptom is acute lower abdominal or pelvic pain, often accompanied by nausea and vomiting (Osmanlıoğlu et al., 2023). However, symptoms may be intermittent because of spontaneous torsion and detorsion or may mimic other acute abdominal conditions, including appendicitis and pelvic inflammatory disease (Fischer & Sanfilippo, 2025). This variability contributes to diagnostic uncertainty, misdiagnosis, and treatment delays in clinical settings (Bridwell et al., 2022). A major diagnostic limitation is the reliance on Doppler ultrasonography, which may demonstrate preserved ovarian blood flow despite torsion because of the ovary's dual arterial supply, potentially providing false reassurance to clinicians (Nouri et al., 2023). Delayed diagnosis and intervention increase the risk of irreversible ovarian damage, compromised reproductive function, and the need for oophorectomy (Fischer & Sanfilippo, 2025).

Adnexal torsion is a time-sensitive condition in which diagnostic and treatment delays may reduce the likelihood of ovarian preservation, particularly when initial clinical findings are inconclusive or misleading. Previous studies have examined various aspects of adnexal torsion, including clinical presentations across different patient populations, the diagnostic accuracy of ultrasonographic findings and emerging imaging modalities, laboratory-based predictors, cognitive factors contributing to misdiagnosis, and outcomes following ovarian-preserving surgery (Bridwell et al., 2022; Dawood et al., 2021; Fischer & Sanfilippo, 2025; Osmanlıoğlu et al., 2023; Wattar et al., 2021). However, these findings have often been examined independently, highlighting the need for an integrated synthesis of clinical variability, diagnostic challenges, and the performance of available diagnostic modalities to support timely intervention and ovarian preservation. The novelty of this narrative review lies in its thematic integration of these factors, particularly its emphasis on cognitive biases as potentially modifiable contributors to diagnostic errors. Accordingly, this review aims to examine the clinical characteristics and risk factors of adnexal torsion, identify factors contributing to misdiagnosis, and evaluate the diagnostic utility of clinical, laboratory, and imaging assessments in facilitating early diagnosis and ovarian preservation. The review also seeks to clarify the relationship between clinical variability and diagnostic uncertainty while providing a practical framework to help emergency physicians and obstetrician-gynecologists maintain a high index of suspicion and prioritize timely surgical evaluation, including diagnostic laparoscopy when clinically indicated.

METHOD

This study employed a narrative literature review based on 25 published sources from 2010 to 2026, including clinical practice guidelines, systematic reviews, meta-analyses, radiologic reviews, observational studies, and case reports. The literature was organized thematically to examine the epidemiology, pathophysiology, risk factors, clinical presentations, diagnostic challenges, cognitive biases, diagnostic accuracy, management strategies, ovarian preservation, and long-term outcomes of adnexal torsion. Findings were synthesized descriptively, with quantitative estimates reported according to the original studies and their respective populations.

RESULTS AND DISCUSSION

Definition of Adnexal Torsion

Adnexal torsion is the partial or complete twisting of the ovary, the fallopian tube, or both on the ligamentous and vascular pedicle that supports them, which obstructs venous and lymphatic flow and, in advanced stages, arterial perfusion. The term ovarian torsion is often used interchangeably, although adnexal torsion has a broader anatomical scope. Torsion may be persistent or intermittent as a result of spontaneous torsion–detorsion episodes. Isolated fallopian tube torsion and torsion of paraovarian or paratubal cysts are rarer forms (Dawood et al., 2021; Huchon & Fauconnier, 2010). The anatomy of the ovary and its supporting structures in the normal state and the changes that occur during adnexal torsion are illustrated in Figure 1.

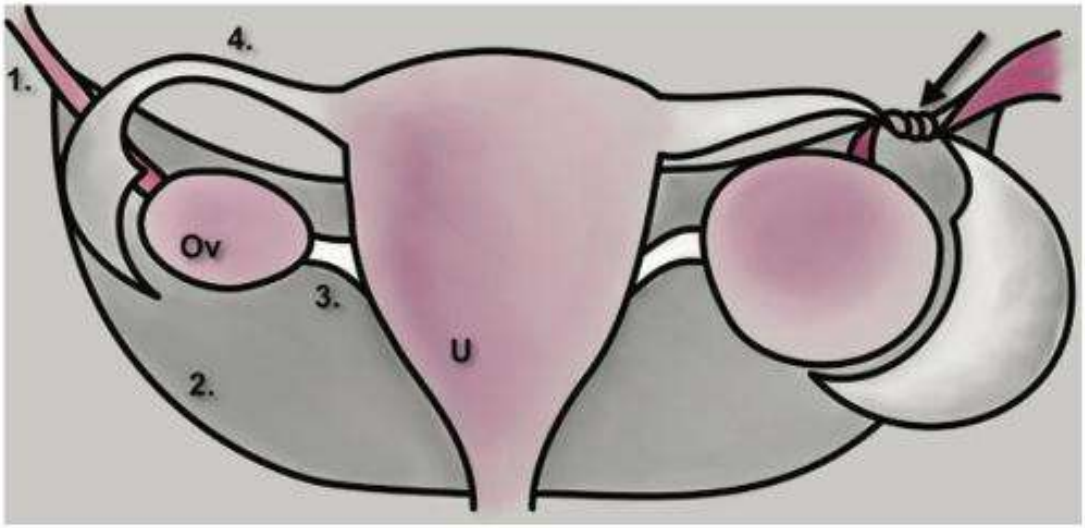


Figure 1. Schematic Anatomy of the Ovary and Its Supporting Structures in the Normal State and the Changes Occurring in Adnexal Torsion

Source: Dawood et al. (2021)

Epidemiology of Adnexal Torsion

Epidemiologically, adnexal torsion is a relatively uncommon but important cause of acute pelvic pain and gynecological emergencies. In a 2021 radiological review, approximately 2%–3% of female patients presenting with acute pelvic pain were reported to have adnexal torsion. This figure is a proportion within a particular clinical population rather than an incidence in the general population, and it should be interpreted according to the study population (American College of Obstetricians and Gynecologists, 2019; Dawood et al., 2021).

Adnexal torsion is found mainly in women of reproductive age, but it can occur from the neonatal period to the postmenopausal period. According to the American College of Obstetricians and Gynecologists (ACOG), approximately 30% of cases occur in females younger than 20 years, with an estimated incidence of about 5 per 100,000 females aged 1–20 years. Right-sided torsion is reported more frequently, accounting for about 64% of cases in the pediatric and adolescent group. In adolescents, torsion may occur even in the absence of an ovarian mass, so the absence of a cyst cannot be used to rule out the diagnosis (American College of Obstetricians and Gynecologists, 2019).

Differences in characteristics according to age, pregnancy, the presence of adnexal lesions, and a history of ovarian procedures or stimulation influence the clinical probability of torsion. The mechanisms of ischemia and the risk factors are described in more detail in the following subsections. Meanwhile, nationally representative epidemiological data on adnexal torsion in Indonesia remain limited (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010).

Pathophysiology of Adnexal Torsion

Adnexal torsion occurs when the ovary, the fallopian tube, or both rotate on the axis of their supporting ligaments, namely the infundibulopelvic ligament and the utero-ovarian ligament (Bridwell et al., 2022). The infundibulopelvic ligament carries the main blood vessels, the ovarian artery and vein, whereas the utero-ovarian ligament connects the ovary to the uterus and contains branches of the uterine artery (Bridwell et al., 2022). Rotation of this vascular axis compresses the adnexal vessels. Because the walls of veins and lymphatic channels are thinner and under lower pressure, obstruction of venous and lymphatic flow occurs earlier than arterial obstruction (Bridwell et al., 2022; Dawood et al., 2021).

Continued obstruction of venous outflow while arterial inflow persists causes ovarian stromal edema and enlargement of the adnexa (Bridwell et al., 2022; Dawood et al., 2021). This ovarian enlargement further aggravates the degree of rotation and vascular compression. If the rotation continues or does not resolve spontaneously, arterial blood flow becomes impaired, triggering hemorrhagic infarction, ischemia, and necrosis of the ovarian tissue (Alsabri et al., 2026; Dawood et al., 2021).

Risk Factors for Adnexal Torsion

The main risk factor underlying adnexal torsion is the presence of an ovarian mass or cyst, particularly one larger than 5 cm (Bridwell et al., 2022; Nouri et al., 2023). An ovarian mass acts as a fulcrum that increases mobility and ultimately allows the ovary to twist (Dawood et al., 2021). The cyst types most frequently found in torsion include simple cysts, mature cystic teratomas (dermoid cysts), and corpus luteum cysts (Dawood et al., 2021; Osmanlıoğlu et al., 2023). Apart from a mass, other risk factors include ovulation induction therapy and ovarian hyperstimulation syndrome (OHSS), a history of pelvic surgery or previous torsion, and structural abnormalities in the form of an elongated utero-ovarian ligament (Bridwell et al., 2022; Nouri et al., 2023).

Adnexal torsion is reported more frequently on the right side than on the left, accounting for 58% to 66% of cases (Nouri et al., 2023; Osmanlıoğlu et al., 2023). Differences in available space and mobility between the two sides of the abdomen are the main explanation for this phenomenon: the sigmoid colon on the left side relatively fixes the position of the left adnexa, whereas the mobility of the cecum and ileum on the right side provides wider space for movement of the right adnexa (Dawood et al., 2021; Osmanlıoğlu et al., 2023).

Spectrum of Clinical Presentation and Population Variation

The clinical presentation of adnexal torsion is highly variable and often non-specific. Abdominal or pelvic pain is the most frequent manifestation, with approximately 90% of patients experiencing some form of pain that may be acute, gradual, or episodic (Bridwell et al., 2022). In one retrospective study, acute abdominal pain localized to one side was reported in 65% of patients with surgically confirmed torsion (Osmanlıoğlu et al., 2023). The characteristics of pain may vary because of episodes of spontaneous torsion and detorsion, so

it does not always appear as severe acute pain (Dawood et al., 2021). At least 10% of patients may experience torsion without typical pain (Bridwell et al., 2022).

Besides pain, nausea and vomiting are the most common accompanying symptoms, reported in 59% to 70% of patients in general and in 83% to 100% of confirmed pediatric cases (Bridwell et al., 2022; Cizek, 2022; Dawood et al., 2021). Vomiting has a strong positive predictive value for distinguishing adnexal torsion from other gynecological causes of pelvic pain (Dawood et al., 2021). Fever is reported in 2% to 20% of cases and may accompany more advanced torsion (Bridwell et al., 2022; Osmanlıoğlu et al., 2023). On physical examination, a palpable abdominal mass can be found in about 20% to 47% of patients (Dawood et al., 2021). Conversely, physical examination may be inconclusive, because up to one-third of patients do not show significant abdominal or pelvic tenderness, especially when spontaneous detorsion occurs (Bridwell et al., 2022). The frequencies of the main signs and symptoms are summarized in Table 1.

Table 1. Frequency of the Main Clinical Signs and Symptoms in Patients with Confirmed Adnexal Torsion

Symptom or Sign	Frequency (%)
Acute pain	44–97
Nausea and/or vomiting	59–70
Fever	2–20
Palpable abdominal mass	20–47

Source: Dawood et al. (2021)

As shown in Table 1, no single sign or symptom is present in all patients, and the ranges reported across studies are wide. The clinical manifestations of adnexal torsion also vary significantly across population groups, especially in pediatric and neonatal patients, pregnant women, and perimenopausal and postmenopausal women, so patient characteristics need to be considered during clinical evaluation.

Pediatric and Neonatal Population

In neonates, adnexal torsion may present with highly non-specific signs such as inconsolability, feeding intolerance, or an abdominal mass found on examination (Cizek, 2022). Unlike in adults, up to 46% of torsion cases in children and adolescents occur in normal ovaries without a pre-existing cyst or mass. This is thought to be related to the flexibility of a longer mesosalpinx (Cizek, 2022; Fischer & Sanfilippo, 2025).

Pregnant Women

In pregnant women, adnexal torsion is reported in 10% to 20% of all torsion cases during pregnancy, with peak incidence in the first trimester, particularly at 10–17 weeks of gestation. This is associated with the development of corpus luteum cysts and the enlarging uterus beginning to rise out of the pelvis (Bridwell et al., 2022; Xu et al., 2024). Pain in pregnant women may be more difficult to recognize because it resembles various other obstetric conditions, such as threatened miscarriage, preterm labor contractions, or fibroid degeneration (Xu et al., 2024).

Perimenopausal and Postmenopausal Women

In perimenopausal and postmenopausal women, adnexal torsion may present with more atypical manifestations. Patients may experience gastrointestinal symptoms such as diarrhea,

abdominal discomfort, or low-grade fever without sudden acute pain (Thanasa et al., 2023). In addition, in postmenopausal women, a twisted adnexal mass requires particular attention because it carries a higher risk of malignancy than in the reproductive-age population (Dawood et al., 2021).

The main differences in presentation across these population groups are summarized in Table 2.

Table 2. Variation in the Clinical Presentation of Adnexal Torsion Across Population Groups

Population	Characteristic Presentation	Clinical Considerations
Neonates, children, and adolescents	Non-specific signs in neonates (inconsolability, feeding intolerance, abdominal mass); nausea and vomiting in 83%–100% of confirmed pediatric cases	Up to 46% of cases occur in normal ovaries without a cyst or mass, possibly related to a longer, more flexible mesosalpinx
Pregnant women	Torsion in 10%–20% of cases during pregnancy, peaking in the first trimester at 10–17 weeks of gestation	Pain may resemble threatened miscarriage, preterm labor contractions, or fibroid degeneration; associated with corpus luteum cysts and uterine enlargement
Perimenopausal and postmenopausal women	Atypical manifestations such as diarrhea, abdominal discomfort, or low-grade fever without sudden acute pain	A twisted adnexal mass carries a higher risk of malignancy than in the reproductive-age population

Source: compiled from Cizek (2022), Fischer and Sanfilippo (2025), Bridwell et al. (2022), Xu et al. (2024), Thanasa et al. (2023), and Dawood et al. (2021)

Diagnosis of Adnexal Torsion

The diagnosis of adnexal torsion is established by integrating the history, physical examination, and supporting investigations while maintaining a high index of clinical suspicion, because no single symptom, sign, or imaging modality can definitively confirm or exclude torsion before surgery. The definitive diagnosis is made by visualizing the adnexa during surgical exploration, usually by laparoscopy (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010).

History Taking

History taking focuses on lower abdominal or pelvic pain, particularly unilateral pain, which may arise suddenly and be severe, colicky, persistent, or intermittent. The characteristics of the pain should be explored, including location and radiation, onset, duration, intensity, pattern of recurrence, and changes since the complaint first appeared. Nausea and vomiting accompanying the pain increase clinical suspicion but are not pathognomonic; the absence of vomiting or severe pain does not exclude adnexal torsion (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010).

The history should also cover ovarian cysts or masses, previous similar episodes of pain, a history of torsion or pelvic surgery, infertility treatment and ovulation induction, and the possibility of pregnancy. The first day of the last menstrual period, the menstrual cycle, delayed menstruation, vaginal bleeding, and contraceptive use are important for assessing the possibility of ectopic pregnancy and other differential diagnoses. Fever, dysuria, changes in bowel habits, and vaginal discharge help assess the possibility of urinary tract infection,

appendicitis, or pelvic inflammatory disease, but they cannot be used as the sole basis for distinguishing these conditions from torsion (American College of Obstetricians and Gynecologists, 2019; Dawood et al., 2021; Huchon & Fauconnier, 2010).

Physical Examination

The examination begins with an assessment of the general condition, level of consciousness, vital signs, and hemodynamic stability. Abdominal evaluation includes inspection, auscultation as needed, and palpation to determine the location and degree of tenderness, the presence of a mass, muscular guarding, rebound tenderness, and signs of peritoneal irritation. Abdominal or pelvic tenderness and an adnexal mass may be found, but relatively minimal physical findings do not exclude torsion, especially during intermittent episodes or in the early phase (American College of Obstetricians and Gynecologists, 2019; Dawood et al., 2021).

In suitable adult patients who consent, a pelvic examination can help evaluate adnexal tenderness, enlargement or masses, cervical motion tenderness, and abnormal discharge as clues to the differential diagnosis. In children and adolescents, bimanual examination is not always necessary or tolerated; the choice of examination should be adapted to age, clinical condition, and the principles of patient comfort and consent (American College of Obstetricians and Gynecologists, 2019).

Supporting Investigations

Laboratory tests serve mainly to evaluate differential diagnoses and to prepare for surgery. A urine pregnancy test or serum β-hCG should be considered in every patient of reproductive age who may be pregnant. A complete blood count, inflammatory markers, and urinalysis can help detect inflammation, infection, or other abnormalities, but leukocytosis, C-reactive protein, and pyuria lack adequate accuracy to confirm or exclude torsion. Parameters such as the neutrophil-to-lymphocyte ratio are adjunctive and should not be the sole basis for deciding on intervention (American College of Obstetricians and Gynecologists, 2019).

Pelvic ultrasonography is the first-line imaging examination. The transabdominal approach is used mainly in children, adolescents, or patients unsuitable for transvaginal ultrasonography, whereas transvaginal ultrasonography can provide additional detail in adult patients when feasible. The examination should assess the size and volume of both ovaries, asymmetric enlargement, stromal edema, peripherally displaced follicles, associated masses or cysts, free pelvic fluid, and a twisted vascular pedicle (whirlpool sign). Doppler findings of reduced venous or arterial flow may support the diagnosis, but detectable flow cannot exclude torsion (American College of Obstetricians and Gynecologists, 2019; Dawood et al., 2021; Ghulmiyyah et al., 2019).

The meta-analysis by Wattar and colleagues published in BJOG in 2021 reported a pooled ultrasonographic sensitivity of 79% and specificity of 76%; when combined with Doppler, the sensitivity was about 80% and the specificity 88%. The variation in results between examinations indicates that a negative ultrasonographic result is insufficient to exclude torsion when the clinical picture is strongly suggestive (Wattar et al., 2021).

Magnetic resonance imaging (MRI) may be considered when ultrasonographic findings are inconclusive, especially during pregnancy or when a complex mass needs characterization. Computed tomography (CT) is more often obtained when a non-gynecological cause of abdominal pain is still being considered, rather than as the first-choice examination for torsion.

Further investigations should be selected selectively and must not delay surgical exploration when clinical suspicion is high (Dawood et al., 2021; Huchon & Fauconnier, 2010; Wattar et al., 2021).

Differential Diagnosis and Diagnostic Confirmation

The main differential diagnoses include ectopic pregnancy, acute appendicitis, hemorrhagic or ruptured ovarian cysts, pelvic inflammatory disease and tubo-ovarian abscess, ureteric colic, urinary tract infection, and other gastrointestinal causes. These are distinguished on the basis of pregnancy status, pain location, abdominal and pelvic examination findings, laboratory parameters, and imaging. Because torsion is a surgical diagnosis, gynecological consultation and diagnostic laparoscopy should be prioritized when suspicion persists even though non-invasive investigations have not confirmed the diagnosis (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010; Wattar et al., 2021).

Misdiagnosis and Cognitive Bias

The rate of preoperative misdiagnosis in adnexal torsion is relatively high. Studies summarized by Fijean et al. show that an incorrect preoperative clinical diagnosis may occur in 25% to 60% of patients undergoing surgical exploration for suspected torsion (Fijean et al., 2026). In the study by Silber et al., 42 of 118 patients with surgically proven torsion, or about 35.6%, were not correctly diagnosed in the emergency department at first (Silber et al., 2022).

Several main factors underlie the high rate of misdiagnosis in adnexal torsion. One of the most important is false reassurance from blood flow that is still detectable on Doppler examination. The ovary has a dual blood supply from the ovarian artery and the adnexal branch of the uterine artery (Alsabri et al., 2026). In the early phase of torsion, or in partial and intermittent torsion, the main obstruction affects venous flow, while arterial vascularization can still be detected in some confirmed cases (Bridwell et al., 2022; Osmanlıoğlu et al., 2023). Therefore, the finding of vascularization on ultrasonography can mislead clinicians and cause adnexal torsion to be excluded (Dawood et al., 2021).

Another contributing factor is the limited skill and evaluation of the ultrasonography operator. The initial examination in the emergency department is often performed by duty physicians or residents who are not ultrasonography experts (Silber et al., 2022). Compared with expert sonographers, non-expert physicians were reported to measure ovarian diameter, evaluate stromal edema, and identify the whirlpool sign less frequently (Silber et al., 2022). Such limitations in systematic evaluation may cause findings supporting torsion to go unrecognized from the initial examination.

Apart from examination limitations, adnexal torsion can also mimic various other abdominal and pelvic emergencies. Conditions with similar manifestations include acute appendicitis, tubo-ovarian abscess (TOA), ruptured or hemorrhagic ovarian cysts, ectopic pregnancy, and urinary tract infection (Tannenbaum et al., 2025). When an ovarian cyst is found on ultrasonography, clinicians may attribute the abdominal pain solely to the cyst without evaluating signs of edema or impaired stromal vascularization around it (Silber et al., 2022).

Misdiagnosis is also influenced by cognitive biases in clinical decision-making and radiological interpretation (Tannenbaum et al., 2025). Anchoring bias describes the tendency of clinicians to fixate on initial findings or on the cyst size recorded by a technician or sonographer, thereby ignoring other signs such as ovarian enlargement and the whirlpool sign

on ultrasonography. Framing bias occurs when clinical or radiological interpretation is influenced by the way a clinical problem or referral information is presented, so that relevant alternative diagnoses are given less consideration. Premature closure occurs when the search for alternative diagnoses stops too early after one initial abnormality has been found; in adnexal torsion, detectable Doppler flow may be regarded as definite proof of the absence of torsion, so other signs, including isolated tubal torsion or intermittent torsion, are no longer evaluated thoroughly. Meanwhile, availability bias refers to the tendency to make diagnostic decisions based on the conditions most easily recalled from daily clinical experience in the emergency department (Tannenbaum et al., 2025). The cognitive biases that can trigger errors in imaging interpretation are defined in Table 3.

Table 3. Definitions and Types of Cognitive Biases that Trigger Imaging Interpretation Errors in Pelvic Emergencies

Cognitive Bias	Definition
Anchoring bias	Tendency for the initial impression to influence the assessment of information gathered later
Attribution bias	Findings are attributed to particular characteristics or stereotypes of the patient (for example, information in the clinical history)
Availability bias	Tendency for diagnostic judgement to be influenced by information or experience that is easily recalled
Base rate neglect	Tendency to ignore the true prevalence of a disease and overestimate its likelihood in order to rule out the worst-case scenario, so as not to miss a rare but meaningful diagnosis
Bandwagon effect	Tendency to act or think in the same way as others
Blind obedience bias	Excessive deference to authority
Confirmation bias	Holding a previously established diagnosis and then seeking evidence that supports it
Familiarity principle and mere-exposure effect	Tendency to consider the more familiar diagnosis rather than the more probable one
Framing bias	Tendency to be influenced by the way the clinical question is asked or the problem is presented
Inattentional bias	Failure to notice a clearly visible but unexpected object because attention is occupied by another task or object
Premature closure	Tendency to reach a conclusion too quickly without considering other possible diagnoses
Regret bias	Tendency to overestimate the likelihood of a disease because the adverse outcome of failing to diagnose it is highly undesirable
Zebra retreat bias	Tendency not to make a rare diagnosis that is actually supported by evidence because of a lack of confidence

Source: Tannenbaum et al. (2025)

Table 3 shows that several of these biases act in the same direction in adnexal torsion: they encourage clinicians to stop the diagnostic search once an apparently sufficient explanation, such as a cyst or preserved Doppler flow, has been found. Recognizing these patterns is therefore relevant not only to radiologists but also to emergency physicians and gynecologists who make the decision to proceed to surgery.

Evaluation of the Accuracy of Diagnostic Modalities and Predictive Parameters

To address the uncertainty of clinical diagnosis, various studies have evaluated the accuracy of ultrasonography, advanced imaging, and laboratory indicators in detecting adnexal torsion.

Standard Ultrasonography (B-Mode and Color Doppler)

A meta-analysis of 18 studies showed that various ultrasonographic signs have relatively high specificity but still variable sensitivity in detecting adnexal torsion (Garde et al., 2023). The pooled accuracy of the most frequently evaluated parameters is presented in Table 4.

Table 4. Pooled Diagnostic Accuracy of Ultrasonographic Signs for Adnexal Torsion

Ultrasonographic Sign	Pooled Sensitivity (%)	Pooled Specificity (%)
Ovarian edema	58	86
Whirlpool sign	65	91
Decreased or absent Doppler flow	53	95
Adnexal mass	69	46
Free pelvic fluid	55	69

Source: Garde et al. (2023)

As shown in Table 4, decreased or absent Doppler flow had the highest specificity but the lowest sensitivity, which explains why preserved flow should not be used to exclude torsion, whereas an adnexal mass and free pelvic fluid showed lower diagnostic accuracy. In the pediatric population, a meta-analysis of 13 studies involving 10,457 patients showed that color Doppler ultrasonography had a pooled sensitivity of 78.6% and specificity of 92.4%. These values were higher than those of grayscale ultrasonography alone, which had a sensitivity of 65.3% and a specificity of 88.7% (Alsabri et al., 2026).

Contrast-Enhanced Ultrasound (CEUS)

The use of microbubble contrast agents in ultrasonography allows direct visualization of ovarian parenchymal perfusion. In the prospective study by Fijean et al., the sensitivity of CEUS reached 100% for expert examiners and 84.3% for non-expert obstetrician-gynecologists, while the specificity was 86% and 89.8%, respectively (Fijean et al., 2026).

Laboratory Markers and Prediction Model

No single routine blood parameter can definitively establish the diagnosis of adnexal torsion. However, an NLR >3 was found in 59.1% of patients with torsion in the study by Aiob et al. and in 82% of patients in the study by Osmanlıoğlu et al. In the study by Aiob et al., an NLR >3 had a sensitivity of 59.1% and a specificity of 74.3% (Aiob et al., 2023; Osmanlıoğlu et al., 2023). The receiver operating characteristic (ROC) curve of the NLR for predicting adnexal torsion is shown in Figure 2.

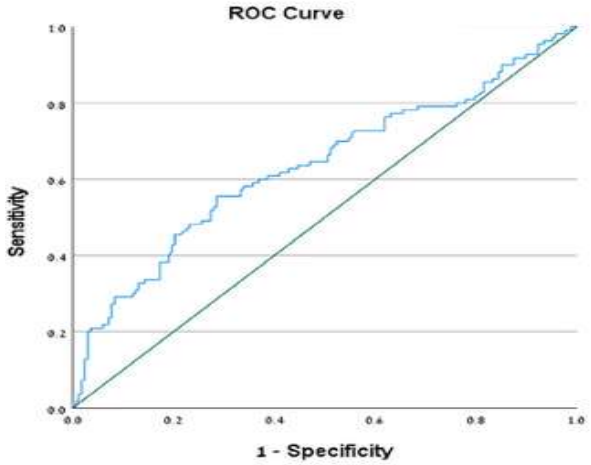


Figure 2. ROC Curve of the Diagnostic Value of the Neutrophil-to-Lymphocyte Ratio (NLR) in Predicting Adnexal Torsion

Source: Aiob et al. (2023)

Because no single instrument can establish the diagnosis independently, a combination of clinical, laboratory, and imaging variables was developed into a predictive model. The model consists of three components, namely vomiting, suspicion of torsion on transvaginal ultrasonography, and an NLR >3 (Aiob et al., 2023). Its performance is summarized in Table 5.

Table 5. Diagnostic Performance of the NLR and the Three-Variable Prediction Model for Adnexal Torsion

Criterion	Sensitivity (%)	Specificity (%)	PPV (%)	Predicted Probability of Torsion (%)
NLR >3 alone	59.1	74.3	–	–
At least two of three variables	47.3	85.7	–	58–76
All three variables	16.4	98.8	90	85

Note: variables are vomiting, suspicion of torsion on transvaginal ultrasonography, and NLR >3; PPV, positive predictive value. Source: Aiob et al. (2023)

Table 5 illustrates the trade-off of the model: when at least two of the three variables are present, the predicted probability of torsion is about 58% to 76%, with a sensitivity of 47.3% and a specificity of 85.7%, whereas when all three variables are present simultaneously, the specificity reaches 98.8% and the PPV 90%, with a sensitivity of 16.4% and a predicted probability of 85% (Aiob et al., 2023). The model is therefore more useful for strengthening suspicion than for ruling torsion out.

Role of CT Scan and MRI

CT is generally not used as the primary modality for diagnosing adnexal torsion, but it may be performed in patients with non-specific abdominal pain. The diagnostic accuracy of CT for adnexal torsion has been reported at 42% (Dawood et al., 2021). Meanwhile, MRI may be beneficial in ambiguous cases or in pregnant women because it has high spatial resolution for identifying the whirlpool sign, which is found in up to 69% of cases, as well as stromal hemorrhage, without exposure to ionizing radiation (Dawood et al., 2021).

The accuracy estimates of the imaging modalities discussed in this review are compiled in Table 6, which shows that every modality has limited sensitivity in at least one setting and that none can replace clinical judgement.

Table 6. Summary of Reported Diagnostic Performance of Imaging Modalities for Adnexal Torsion

Modality	Population or Setting	Reported Performance
Ultrasonography	Meta-analysis (Wattar et al., 2021)	Sensitivity 79%; specificity 76%
Ultrasonography combined with Doppler	Meta-analysis (Wattar et al., 2021)	Sensitivity about 80%; specificity 88%
Color Doppler ultrasonography	Pediatric meta-analysis, 13 studies, 10,457 patients (Alsabri et al., 2026)	Sensitivity 78.6%; specificity 92.4%
Grayscale ultrasonography alone	Pediatric meta-analysis (Alsabri et al., 2026)	Sensitivity 65.3%; specificity 88.7%
Contrast-enhanced ultrasound	Expert examiners (Fijean et al., 2026)	Sensitivity 100%; specificity 86%
Contrast-enhanced ultrasound	Non-expert obstetrician-gynecologists (Fijean et al., 2026)	Sensitivity 84.3%; specificity 89.8%
Computed tomography	Radiological review (Dawood et al., 2021)	Diagnostic accuracy 42%
Magnetic resonance imaging	Radiological review (Dawood et al., 2021)	Whirlpool sign identified in up to 69% of cases

Source: compiled from the studies cited in the table

Initial Management and Therapeutic Approach

Adnexal torsion is an operative emergency that requires immediate assessment and consultation with an obstetrics and gynecology specialist. Initial management includes identifying hemodynamic compromise, evaluating pregnancy status, establishing intravenous access as indicated, administering fluids when necessary, controlling pain with analgesics, giving antiemetics for vomiting, and preparing for anesthesia and surgery. Patients with suspected torsion who require exploration are generally kept nil by mouth according to perioperative protocols. Stabilization of the patient and investigation of life-threatening alternative diagnoses are carried out simultaneously without delaying the necessary definitive treatment (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010).

Preoperative pharmacological therapy is supportive and cannot replace detorsion. The choice of analgesics and antiemetics should consider age, pregnancy status, organ function, and individual contraindications. Antibiotics are not given as specific therapy for torsion without evidence of infection, but according to clinical indication or relevant perioperative prophylaxis protocols. Delaying exploration merely to await repeated radiological examinations should be avoided when clinical assessment continues to indicate strong suspicion (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010).

Diagnostic and therapeutic laparoscopy is the preferred approach when the patient is stable and there are no technical contraindications, because it allows confirmation of the diagnosis, detorsion, and direct assessment of associated lesions. In children, adolescents, and

women of reproductive age, the conservative strategy aims to preserve the ovary and fallopian tube even when the ovary appears bluish or blackish. The decision to perform cystectomy is made individually according to lesion morphology, tissue condition, and the risk of damage to the ovarian cortex. The indication for tissue removal should consider suspicion of malignancy and tissue damage that cannot be salvaged (American College of Obstetricians and Gynecologists, 2019; Balasubramaniam et al., 2020; Huchon & Fauconnier, 2010).

In pregnancy, the decision to operate considers gestational age, uterine size, the appearance of the mass, and the maternal condition. The retrospective study by Wang and Deng of 82 pregnant patients with confirmed torsion showed that 63 patients (76.8%) underwent laparoscopy and that conservative management was performed in most cases judged suitable. These findings support the feasibility of timely operative management, but the interpretation of maternal and fetal safety must take into account the observational nature of the study and patient characteristics (Wang & Deng, 2020). After surgery, management includes monitoring of pain and vital signs, mobilization as appropriate, evaluation of complications, and counseling about intraoperative findings and procedures (American College of Obstetricians and Gynecologists, 2019; Balasubramaniam et al., 2020).

Implications for Surgical Management and Ovarian Preservation

Surgery is the main standard for confirming the diagnosis and providing definitive treatment of adnexal torsion (Bridwell et al., 2022; Cizek, 2022). The minimally invasive laparoscopic approach is preferred over laparotomy because it offers various advantages, such as less tissue trauma, less bleeding, milder postoperative pain, and faster recovery (Nouri et al., 2023; Xu et al., 2024). In pregnant patients, laparoscopy has also been reported to be safe in all trimesters, providing good exposure of the operative field without significantly increasing the risk of miscarriage or preterm delivery (Osmanlıoğlu et al., 2023; Xu et al., 2024).

The main goal of surgical management of adnexal torsion, especially in women of reproductive age and in children and adolescents, is to preserve ovarian tissue through detorsion, that is, returning the twisted adnexa to its original position (Fischer & Sanfilippo, 2025; Osmanlıoğlu et al., 2023). In recent years, there has been a change in the approach to determining ovarian viability during surgery. Viability is no longer assessed solely on the macroscopic appearance of the ovary, because discoloration or severe edema does not always indicate permanent necrosis.

Assessment of Ovarian Viability

An ovary that appears blackish or bluish, or is severely edematous at surgical exploration, cannot be assumed with certainty to have undergone permanent necrosis (Fischer & Sanfilippo, 2025; He et al., 2022). Various clinical studies show that most ovaries that appear severely ischemic at detorsion can still maintain ovarian function. In several series, approximately 90% to 94% of ischemic twisted ovaries treated with detorsion showed normal follicular development at follow-up evaluation (Bridwell et al., 2022; Cizek, 2022; Tielli et al., 2022).

Risk of Thromboembolism after Detorsion

There is no clinical evidence supporting the concern that detorsion can release venous thrombi from the twisted vascular pedicle and cause pulmonary embolism (Fischer & Sanfilippo, 2025; Osmanlıoğlu et al., 2023). The incidence of pulmonary embolism in adnexal

torsion is reported to be very low, at about 0.2%, and this risk does not increase with detorsion (Xu et al., 2024).

Malignancy Considerations in the Pediatric Population

In children and adolescents, an underlying malignancy of the ovarian mass needs to be considered when determining the surgical procedure. However, the rate of malignancy in pediatric patients with ovarian torsion is reported to be low. One large study found a malignancy rate of 1.8%, while another reported a range of 0.4% to 5% in premenarchal patients with ovarian torsion (Cizek, 2022; Fischer & Sanfilippo, 2025; Tielli et al., 2022). Routine removal of the ovary in this population is therefore not recommended.

Regarding the management of cysts or masses accompanying torsion, cystectomy together with detorsion should ideally be performed to remove the fulcrum of the torsion (Cizek, 2022). However, when the ovarian parenchyma is very edematous and friable and the surgical plane is difficult to identify, forcing a cystectomy may increase the risk of bleeding and damage to the ovarian cortex (Cizek, 2022; Fischer & Sanfilippo, 2025). In such situations, detorsion alone accompanied by aspiration or fenestration of the cyst fluid may be performed, followed by periodic ultrasonographic evaluation 6 to 12 weeks after surgery to determine the need for subsequent elective cystectomy (Cizek, 2022; Fischer & Sanfilippo, 2025).

Radical procedures in the form of oophorectomy or salpingo-oophorectomy are indicated only in certain conditions, such as when the ovary has undergone severe total necrosis with extensive tissue damage, in postmenopausal women in whom ovarian function has declined and the risk of malignancy is higher, or when there is clear macroscopic evidence of malignancy (Cizek, 2022; Osmanlıoğlu et al., 2023). In torsion of a normal ovary without a cyst, or torsion caused by excessively long supporting ligaments, oophoropexy, that is, fixation of the ovary to the pelvic wall or the utero-ovarian ligament, may be considered to reduce the risk of recurrent torsion (Tielli et al., 2022; Xu et al., 2024).

Prognosis and Long-Term Follow-Up

The prognosis of adnexal torsion is generally better when the condition is recognized and treated early by detorsion. Outcomes are influenced by the duration and degree of torsion, the possibility of spontaneous detorsion episodes, vascular involvement, the presence of an associated mass, and the condition of the tissue at surgery. Although delay may increase the risk of ischemia and organ loss, a precise time threshold for irreversible ovarian damage has not been consistently established. Therefore, an ovary that appears dark or edematous should not be immediately considered to have lost viability permanently (American College of Obstetricians and Gynecologists, 2019; Huchon & Fauconnier, 2010).

Recovery of Function and Fertility Potential

Successful ovarian preservation can be evaluated by the recovery of size and vascularization and the appearance of follicles on follow-up ultrasonography. In the 2020 prospective study by Balasubramaniam and colleagues, detorsion preserved 45 of 46 ovaries for which preservation was attempted (97.8%), and all preserved ovaries showed follicles and vascularization on follow-up ultrasonography. These results support the benefit of detorsion but cannot be generalized as a success rate for all patients or as a guarantee of long-term fertility (Balasubramaniam et al., 2020).

In the pediatric population, Geimanaite and Trainavicius (2019) reported that 42 ovaries in 39 patients preserved after detorsion regained appropriate anatomy and follicular

development during ultrasonographic evaluation. Although recovery of morphology and folliculogenesis is a favorable prognostic indicator, long-term clinical fertility data after torsion remain more limited than data on the recovery of ovarian vascularization and morphology (Geimanaite & Trainavicius, 2019).

Risk of Recurrence

Adnexal torsion can recur, especially in patients with a history of torsion episodes, a highly mobile ovary, or an untreated mass. Bart and colleagues (2021) reported recurrent torsion in 22 of 182 patients (12.1%) after laparoscopic detorsion. The recurrence rate was associated with the degree of twisting at the first event, as summarized in Table 7. These figures come from a single retrospective cohort and do not reflect the individual risk for every population (Bart et al., 2021).

Table 7. Recurrence of Adnexal Torsion after Laparoscopic Detorsion According to the Degree of Twisting at the First Event

Degree of Twisting at First Event	Recurrence Rate (%)
≤360°	4.3
361°–720°	14.5
>720°	20.0
Overall (22 of 182 patients)	**12.1**

Source: Bart et al. (2021)

Oophoropexy may be considered selectively in patients with recurrent torsion or certain anatomical predispositions, but the decision must weigh the expected benefits, procedural risks, and the limited evidence of its effectiveness. Counseling should include the possibility of recurrence and the importance of returning promptly to a health facility if acute pelvic pain recurs (American College of Obstetricians and Gynecologists, 2019; Bart et al., 2021).

Clinical Follow-Up

Postoperative monitoring aims to ensure improvement of symptoms, detect complications or recurrence, and assess adnexal masses that have not been resected. When a cyst is left in situ because of tissue edema or friability, ACOG recommends repeat ultrasonographic evaluation within 6–12 weeks to confirm resolution or determine the need for elective intervention. Additional assessment of ovarian function may be considered according to clinical findings, reproductive plans, and the course of the disease; routine testing of ovarian reserve markers in every patient is not necessary without a specific indication (American College of Obstetricians and Gynecologists, 2019; Geimanaite & Trainavicius, 2019).

In pregnant patients, prognosis also needs to take into account maternal health and pregnancy outcomes. In the study by Wang and Deng (2020), most patients who underwent surgery for torsion still achieved live births; however, the results of a single retrospective series cannot be used to rule out pregnancy risks for all patients. With timely diagnosis, appropriate intervention, and targeted monitoring, the main goal of management is to preserve adnexal function and minimize long-term effects on reproductive health (Balasubramaniam et al., 2020; Wang & Deng, 2020).

CONCLUSION

Adnexal torsion is a gynecologic surgical emergency characterized by variable clinical presentations, ranging from acute unilateral pelvic or lower abdominal pain accompanied by nausea and vomiting to intermittent or atypical symptoms, particularly among pediatric, pregnant, and postmenopausal patients. Diagnosis remains challenging because of overlapping symptoms with other conditions, limitations of ultrasonography, preserved blood flow on Doppler examination, and cognitive biases that may contribute to misdiagnosis or diagnostic delays. Diagnostic assessment should therefore integrate clinical manifestations, laboratory findings, and ultrasonographic features. Predictive models incorporating vomiting, ultrasonographic suspicion of torsion, and a neutrophil-to-lymphocyte ratio (NLR) greater than 3, along with advanced imaging modalities such as contrast-enhanced ultrasonography and magnetic resonance imaging (MRI) in selected cases, may provide additional diagnostic support. Surgical management should prioritize prompt detorsion and ovarian preservation, particularly in children, adolescents, and women of reproductive age, because a dark or ischemic ovarian appearance does not necessarily indicate irreversible necrosis and should not independently justify oophorectomy. Clinicians should maintain a high index of suspicion in patients presenting with acute pelvic pain, avoid excluding torsion solely on the basis of preserved Doppler flow or the absence of an ovarian cyst, perform systematic ultrasonographic evaluation, and recognize cognitive biases that may lead to premature diagnostic closure. When clinical suspicion persists, timely surgical exploration, preferably through laparoscopy when appropriate, should be prioritized to maximize the likelihood of ovarian preservation. Overall, recognizing diverse clinical presentations, addressing potential sources of diagnostic error, and integrating clinical, laboratory, and imaging findings are essential for facilitating timely diagnosis, guiding appropriate management, and preserving ovarian function.

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AUTHOR CONTRIBUTIONS

The authors contributed fully to the formulation of the main idea, the collection of literature data (library research), the analysis and interpretation of the literature, and the preparation of the manuscript. All authors approved the final version of the manuscript.

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The authors declare that generative artificial intelligence (AI) was used in the preparation of this manuscript. The authors acknowledge the use of generative AI to help improve language clarity and the grammatical structure of the manuscript. This use complied with applicable ethical guidelines on the use and disclosure of generative AI in scientific research. Each author made a substantial intellectual contribution to this work. The entire content of the manuscript was carefully reviewed to ensure its accuracy, and the authors take full responsibility for the integrity and final content of the manuscript.

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