



# ACOG COMMITTEE OPINION

Number 783

## Committee on Adolescent Health Care

*The North American Society for Pediatric and Adolescent Gynecology endorses this document. This Committee Opinion was developed by the American College of Obstetricians and Gynecologists' Committee on Adolescent Health Care in collaboration with committee members Margaret Abraham, MD, MSc, and Erin A. Keyser, MD.*

## Adnexal Torsion in Adolescents

**ABSTRACT:** Adnexal torsion is the fifth most common gynecologic emergency. The most common ovarian pathologies found in adolescents with adnexal torsion are benign functional ovarian cysts and benign teratomas. Torsion of malignant ovarian masses in this population is rare. In contrast to adnexal torsion in adults, adnexal torsion in pediatric and adolescent females involves an ovary without an associated mass or cyst in as many as 46% of cases. The most common clinical symptom of torsion is sudden-onset abdominal pain that is intermittent, nonradiating, and associated with nausea and vomiting. If ovarian torsion is suspected, timely intervention with diagnostic laparoscopy is indicated to preserve ovarian function and future fertility. When evaluating adolescents with suspected adnexal torsion, an obstetrician–gynecologist or other health care provider should bear in mind that there are no clinical or imaging criteria sufficient to confirm the preoperative diagnosis of adnexal torsion, and Doppler flow alone should not guide clinical decision making. In 50% of cases, adnexal torsion is not found at laparoscopy; however, in most instances, alternative gynecologic pathology is identified and treated. Adnexal torsion is a surgical diagnosis. A minimally invasive surgical approach is recommended with detorsion and preservation of the adnexal structures regardless of the appearance of the ovary. A surgeon should not remove a torsed ovary unless oophorectomy is unavoidable, such as when a severely necrotic ovary falls apart. Although surgical steps may be similar to those taken when treating adult patients, there are technical adaptations and specific challenges when performing gynecologic surgery in adolescents. A conscientious appreciation of the physiologic, anatomic, and surgical characteristics unique to this population is required.

## Recommendations and Conclusions

The American College of Obstetricians and Gynecologists makes the following recommendations and conclusions:

- Obstetrician–gynecologists who treat mainly adults are commonly consulted to manage adnexal torsion in an adolescent. Although surgical steps may be similar to those taken when treating adult patients, there are technical adaptations and specific challenges when performing gynecologic surgery in adolescents.
- The most common clinical symptom of torsion is sudden-onset abdominal pain that is intermittent, nonradiating, and associated with nausea and vomiting.
- There are no clinical or imaging criteria sufficient to confirm the preoperative diagnosis of adnexal torsion.
- Doppler flow alone should not guide clinical decision making.
- Although more than one half of cases of pediatric and adolescent adnexal torsion occur in the setting of an adnexal mass, cancer in this age group rarely presents as adnexal torsion.
- If ovarian torsion is suspected, timely intervention with diagnostic laparoscopy is indicated to preserve ovarian function and future fertility.
- A minimally invasive surgical approach is recommended with detorsion and preservation of the adnexal structures regardless of the appearance of the ovary.
- A surgeon should not remove a torsed ovary unless oophorectomy is unavoidable, such as when a severely necrotic ovary falls apart.

- A cystectomy does not need to be performed at the time of detorsion because it may cause additional trauma. If a cystectomy is not performed, a surgeon may consider incision and drainage for large cysts. Ultrasonography to reevaluate the cyst at 6–12 weeks is recommended.
- Adolescents are a unique population with specific needs; thus, special care for placement of ports and lower insufflation pressure may be indicated. Multispecialty collaboration is crucial to optimize care and ensure that minimally invasive detorsion with ovarian preservation is the standard treatment provided to adolescents with adnexal torsion.

## Background

Adnexal torsion, including torsion of a normal or pathologic ovary, torsion of the fallopian tube, paratubal cyst, or a combination of these conditions, is the fifth most common gynecologic emergency. Thirty percent of all cases of adnexal torsion occur in females younger than 20 years (1). Approximately 5 of 100,000 females aged 1–20 years are affected, (2, 3) with girls older than 10 years at increased risk because of hormonal influences and gonadal growth that result in an increased frequency of physiologic and pathologic masses (4–6). The risk of torsion increases when pelvic masses exceed 5 cm (7). The most common ovarian pathologies found in adolescents with adnexal torsion are benign functional ovarian cysts and benign teratomas (8). Torsion of malignant ovarian masses in this population is rare (9, 6).

Sixty-four percent of torsions occur on the right side (10). The lower rate of torsion on the left side is attributed to the protective nature of the descending colon. In contrast to adnexal torsion in adults, adnexal torsion in pediatric and adolescent females involves an ovary without an associated mass or cyst in as many as 46% of cases (11). Congenitally long ovarian ligaments, excessive laxity of the pelvic ligaments, or a relatively small uterus that allows more space for the adnexa to twist on its axis may be predisposing factors (8, 6). Rare cases of isolated tubal torsion and bilateral adnexal torsion are reported in the pediatric literature, and they are almost always associated with tubal pathology, such as hydrosalpinx or paratubal cyst (12). If ovarian torsion is suspected, timely intervention with diagnostic laparoscopy is indicated to preserve ovarian function and future fertility.

## Evaluation of Adolescents With Adnexal Torsion

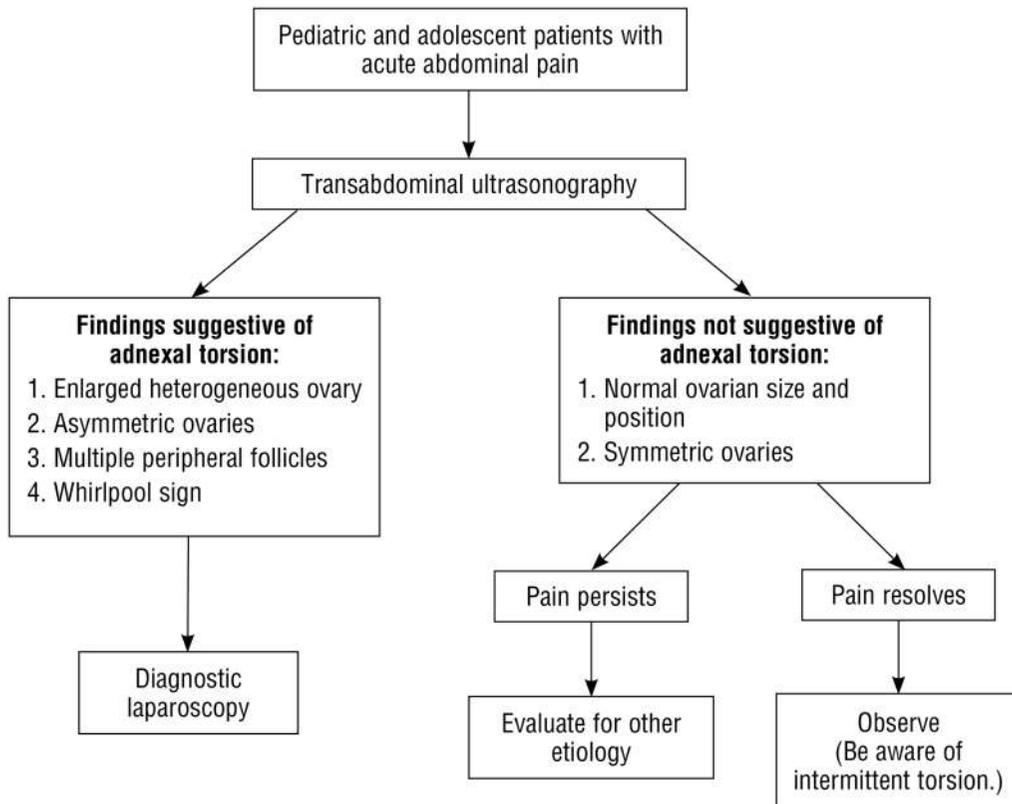
When evaluating adolescents with suspected adnexal torsion, an obstetrician–gynecologist or other health care provider should bear in mind that there are no clinical or imaging criteria sufficient to confirm the preoperative diagnosis of adnexal torsion. Patients with a clinical suspicion for adnexal torsion should

undergo emergent diagnostic laparoscopy (13) (Fig. 1). The differential diagnosis of an adolescent presenting with abdominal pain is broad (11) and the presentation of adnexal torsion is nonspecific. The most common clinical symptom of torsion is sudden-onset abdominal pain that is intermittent, nonradiating, and associated with nausea and vomiting. Nausea and vomiting are reported in 62% and 67% of cases, respectively (14). Data suggest that nausea and vomiting more commonly occur in premenarchal patients (2), and these symptoms are more commonly reported in pediatric and adolescent patients with torsion than in those with an ovarian cyst alone (15). Clinical signs of adnexal torsion include abdominal tenderness, which is reported in up to 88% of patients with adnexal torsion. Rebound and peritoneal signs are reported in only 12–27% of patients (14, 16). Clinical signs also may include a palpable adnexal mass (17). However, a bimanual examination generally is not necessary or tolerated in pediatric and adolescent patients (6).

None of the following tests are useful in the diagnosis of adnexal torsion: leukocytosis, pyuria, C-reactive protein, and erythrocyte sedimentation rate. In small studies, interleukin-6 and D-dimer show promise as biochemical markers of torsion (8); however, they have not been studied in adolescents.

Transabdominal ultrasonography is the imaging modality of choice. It has a sensitivity of 92% and specificity of 96% in detecting adnexal torsion (18). When torsed, all ovaries are enlarged. A completely normal-appearing ovary on ultrasonography is unlikely to be twisted. In a study of 41 pediatric and adolescent patients with torsion, torsed ovaries on ultrasonography were on average 12 times the volume of the normal contralateral side (19). Ultrasonography findings suggestive of ovarian torsion include unilateral ovarian enlargement, ovarian edema characterized by the presence of a hyperechogenic ovary with peripherally displaced follicles and echogenic stroma, free fluid, and a coiled vascular pedicle (referred to as the “whirlpool sign”) (17) (Fig. 2). The whirlpool sign is highly specific but technically difficult to visualize on transabdominal ultrasonography. The use of Doppler studies in detecting adnexal torsion is limited because of their low sensitivity and operator dependency. The presence of Doppler arterial flow does not rule out torsion; for instance, one study reported normal Doppler arterial flow in as many as 60% of surgically confirmed cases of adnexal torsion (11). Preservation of Doppler arterial flow can be explained by intermittent torsion, collateral blood supply from the utero-ovarian vessels or infundibulopelvic vessels, or a torsed paratubal cyst. Doppler flow alone should not guide clinical decision making.

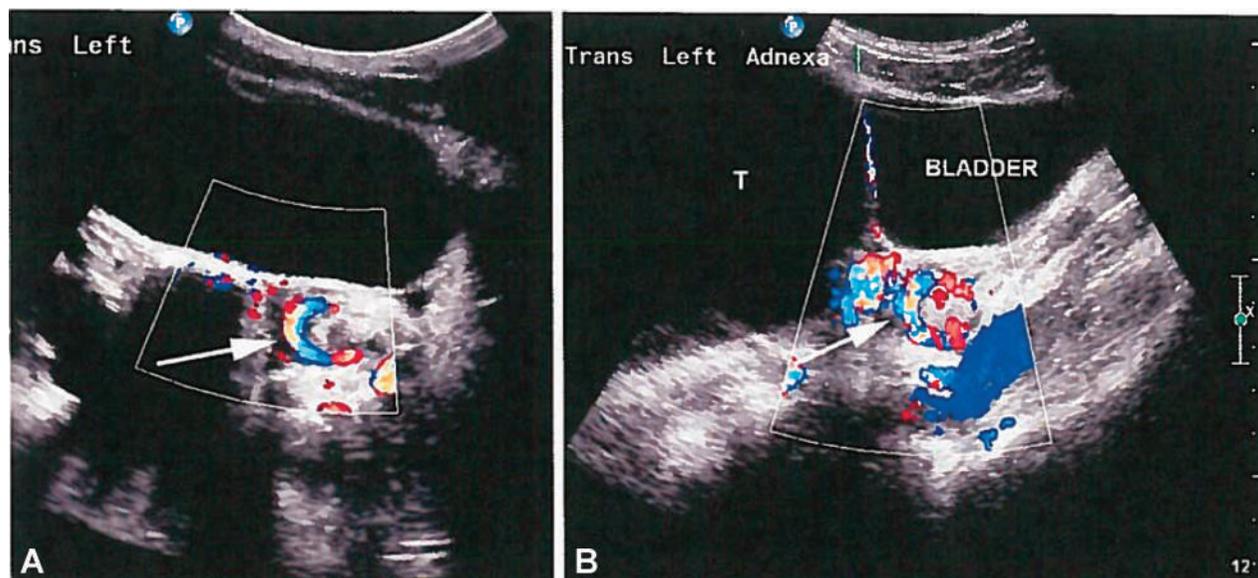
Computed tomography or magnetic resonance imaging often is performed while evaluating a patient for causes of abdominal pain. If computed tomography



**Figure 1.** Diagnosis and management of adnexal torsion in the adolescent.

imaging is obtained, findings that may indicate adnexal torsion include asymmetric ovarian enlargement, uterine deviation toward the pathologic side, pelvic free fluid,

and fat stranding adjacent to the ovary (20). When computed tomography imaging suggests torsion, surgery should not be delayed to wait for ultrasonography (21).



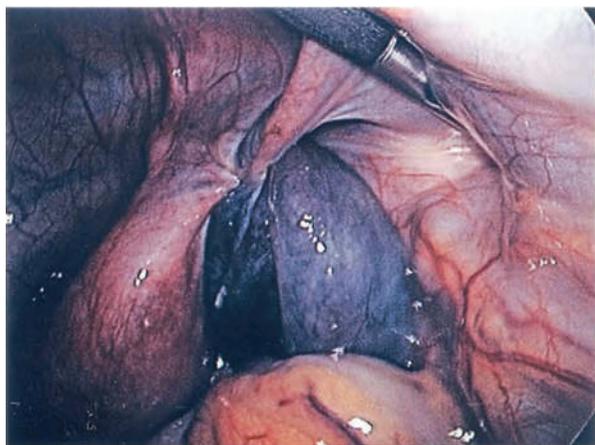
**Figure 2.** Ultrasound whirlpool sign in ovarian torsion (A and B). Color flow on Doppler ultrasonographic image demonstrates the twisted pedicle (arrows) in a 12-year-old girl with a large, mature cystic teratoma (T) arising from the left adnexa, representing the lead point for left adnexal torsion. Reprinted from Ngo AV, Otjen JP, Parisi MT, Ferguson MR, Otto RK, Stanescu AL. Pediatric ovarian torsion: a pictorial review. *Pediatr Radiol* 2015;45:1845–55; quiz 1842–4.

Similarly, magnetic resonance imaging may show decreased ovarian enhancement post contrast, asymmetric enlargement of the ovary, uterine deviation toward the pathologic side, and presence of multiple small peripherally located follicles, typically best seen on T2-weighted images (22).

Adnexal torsion is a surgical diagnosis (7). To reduce the number of negative laparoscopies performed, composite indices have been developed to better identify torsion before surgery (23, 24). These indices combine clinical and radiologic predictors of adnexal torsion (eg, vomiting, adnexal volume, and the adnexal volume ratio [volume of affected ovary/volume of unaffected ovary]) into a composite score that more accurately predicts torsion (24). Further studies are needed to validate these scores; however, these studies highlight the positive correlation of vomiting and adnexal volume ratio with adnexal torsion. In 50% of cases, adnexal torsion is not found at laparoscopy; however, in most instances, alternative gynecologic pathology is identified and treated (25, 26). Given the importance of ovarian preservation, especially for pediatric and adolescent patients, a negative finding at laparoscopy is an acceptable clinical outcome.

### Management of Adnexal Torsion

Although the viability of an ovary declines as time elapses from the onset of pain to surgical detorsion, the ovary's dual blood supply makes it resilient to vascular injury, and the exact duration of vascular interruption needed to cause irreversible damage to the ovary is unknown (10, 27–29). Although two retrospective studies suggest that a sharp decrease in ovarian function occurs 72 hours after the onset of symptoms, the ovary is resilient, and function may persist much longer (30, 10).



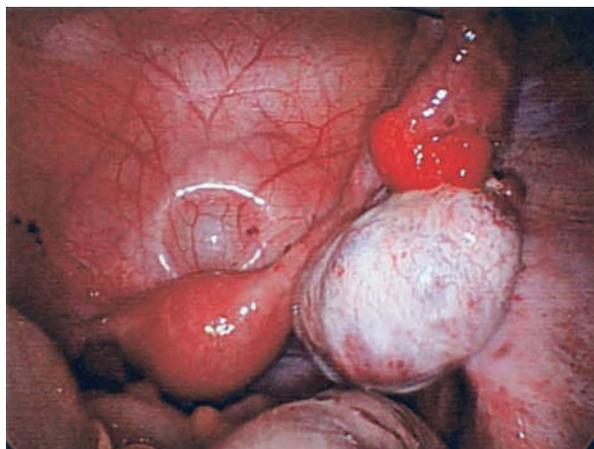
**Figure 3.** Ovarian torsion. Reprinted from Harkins G. Ovarian torsion treated with untwisting: second look 36 hours after untwisting. *J Minim Invasive Gynecol.* 2007 May-Jun;14(3):270.

An unfounded myth contributing to unnecessary oophorectomy is that a black or blue ovary suggests necrosis and thus should be removed. The appearance of the ovary at surgery is not a reliable indicator of ovarian viability. Multiple studies report future ovarian function despite a grossly ischemic appearance at the time of surgery (8, 25, 28, 31–36). After detorsion, improvements in the color of the ovary may not be seen intraoperatively; however, at second-look laparoscopy, near-normal appearing ovaries are seen 36 hours after untwisting a blue-black ovary (See Fig. 3 and Fig. 4). A second unfounded myth leading to unnecessary oophorectomies is that embolic phenomena will occur after untwisting. There is no evidence to support this practice and no cases of venous thromboembolism after detorsion have been reported in the literature (3, 37). The goals of surgery are to detorse the adnexa and preserve the ovary regardless of its appearance and the timing of presentation.

### Operative Considerations

#### Preoperative Counseling

As with all medical procedures, obstetrician-gynecologists should engage patients (and their medical decision makers for unemancipated patients younger than 18 years) in the informed consent process in accordance with current state laws (38). Required consent includes the patient's parent(s) or legal guardian(s) and may include a court-appointed medical decision maker. There may be special provisions for patients with intellectual or developmental delays even if they are older than 18 years. Patients should be present when appropriate, although their involvement in preoperative discussions will be affected by age and understanding. In addition to standard procedural risks, surgeons should address other considerations such as the following: the



**Figure 4.** Ovary 36 hours after untwisting. Reprinted from Harkins G. Ovarian torsion treated with untwisting: second look 36 hours after untwisting. *J Minim Invasive Gynecol.* 2007 May-Jun;14(3):270.

possibility of a negative laparoscopy, the potential for a two-staged procedure in the event that removal of an underlying cyst is deferred, the need for postprocedure surveillance, and risk of recurrent ovarian torsion. In special circumstances, a discussion on the possibility of an underlying malignancy is warranted.

### **Surgical Approach**

Obstetrician–gynecologists who mainly treat adults are commonly consulted to manage adnexal torsion in an adolescent. Although surgical steps for adolescents may be similar to those taken when treating adult patients, there are technical adaptations and specific challenges when performing gynecologic surgery in adolescents. A conscientious appreciation of the physiologic, anatomic, and surgical characteristics unique to this population is required (39). A minimally invasive approach with laparoscopy is preferred. When performing laparoscopy, two unique characteristics of adolescent patients must be considered. First, the abdominal wall tissue integrity varies because fascial wall tension and strength increases with age through adolescence (40). This translates into a wide range of abdominal wall puncture pressure that should be considered to avoid injury to underlying structures. Second, adolescents are at higher risk of vascular injury involving the aorta, inferior vena cava, or left common iliac vein because the distance from these major vessels to the umbilical entry site is short. These characteristics must be respected when planning and executing laparoscopic entry. Placement of secondary trocars (and laparotomy incisions when needed) requires an appreciation for the attenuated cranial to caudal distance and lateral abdominal and pelvic distances in the adolescent. The smallest possible trocars should be used, and fascial closure should be considered because this patient population is at increased risk of fascial herniation when compared with adults (41). The process of insufflation requires modification because tolerable maximum distention pressure is lower in pediatric and adolescent patients (39, 42). Although specific age or weight cutoffs have not been established, in adolescents weighing 20 kg or greater, starting insufflation pressure of 12 mm Hg and flow rates of 3–6 L/min are generally well tolerated (43). Lower pressure ranges and flow rates are recommended in pediatric and adolescent patients weighing less than 20 kg.

### **Management of Adnexal Masses**

Many obstetrician–gynecologists cite the fear of leaving behind a potential malignancy as a reason to perform oophorectomy. Although more than one half of cases of pediatric and adolescent adnexal torsion occur in the setting of an adnexal mass, cancer in this age group rarely presents as adnexal torsion (8, 9). The rate of malignancy among premenarchal adolescents with ovarian torsion ranges from 0.4 to 5% (9, 44, 37). Notably, edema of the ovary causes enlargement, and the

edema itself can be interpreted mistakenly as an ovarian tumor on imaging studies. If a cyst is present at the time of adnexal torsion, it is likely benign. In many cases, the twisted adnexa can be detorsed, and if a cyst is identified, it is reasonable to proceed with a concomitant cystectomy. Occasionally, the twisted adnexa are severely edematous and friable, and in such cases, attempts at cystectomy can result in ovarian tissue damage and bleeding that may lead to oophorectomy. A cystectomy does not need to be performed at the time of detorsion because it may cause additional trauma. If a cystectomy is not performed, a surgeon may consider incision and drainage for large cysts. Ultrasonography to reevaluate the cyst at 6–12 weeks is recommended (8, 33). Simple cysts typically resolve within 6–8 weeks. In pediatric and adolescent patients with persistent cysts, a laparoscopic ovarian cystectomy can be performed given the risk of recurrent torsion. Cysts measuring 5 cm or more after detorsion should be treated in accordance with published clinical practice guidelines (45). Ovulation suppression (eg, with combination oral contraceptive pills or depot medroxyprogesterone acetate) can be initiated to prevent recurrent physiologic cysts (6, 28).

### **Oophoropexy**

Oophoropexy is a surgical procedure that fixes the ovary in position limiting its range of movement. The two strongest indications to perform this procedure are repeat torsion or an absent contralateral ovary (46, 47). The overall recurrence rate of ovarian torsion is low, ranging from 2% to 12%; although, reportedly, the rate is higher in spontaneously torsed normal adnexa (48, 8). Oophoropexy is controversial and current data are insufficient to support performing an oophoropexy to decrease the risk of recurrent ovarian torsion (47, 13, 44).

### **Pain Management**

Pain frequently is undertreated in children and adolescents undergoing surgical procedures (49). Several intraoperative measures can be taken to minimize pain after laparoscopy, such as avoiding excessively high or prolonged intraabdominal pressure, removing all insufflating carbon dioxide at the end of the procedure, and infiltrating all trocar sites with local anesthetic (50). In a systematic review of postoperative pain regimens including acetaminophen, codeine, and hydrocodone, a mild-to-modest benefit was observed with a variety of interventions, with no consensus on a preferred regimen (51). Expert opinion suggests that laparoscopic adnexal detorsion improves an adolescent patient's pain. Postoperative pain control is achieved with scheduled nonsteroidal antiinflammatory medications in combination with a short course (3 days or less) of opiates. Judicious use of opioids, including tramadol, is advised because adolescents prescribed opioids for as few as 7 days can develop dependence (52). Many children's hospitals now use dedicated pain service teams for

evaluation and treatment of pediatric pain (53), and consultation with such services or pediatric specialists is especially helpful for obstetrician–gynecologists unfamiliar with postoperative pediatric pain medication preferences and weight-based dosages.

### Postoperative Counseling and Follow-up

Adolescents generally recover well from surgery and resume activity quickly. Weight-based lifting restrictions often are minimal, and most adolescents will self-limit activities because of discomfort. Patients in whom a cyst was noted but not removed at the time of detorsion should be counseled to limit high-impact activities pending interval ultrasonography findings. The postoperative visit is crucial for patient and parent or guardian education and counseling. This discussion should include details of the diagnosis and procedure, prevention and likelihood of recurrence, potential effect on future fertility, and need for additional imaging (13).

### Conclusion

The differential diagnosis of an adolescent presenting with abdominal pain should include adnexal torsion. A minimally invasive surgical approach is recommended with detorsion and preservation of the adnexal structures regardless of the appearance of the ovary. Surgeons should not remove a torsed ovary unless oophorectomy is unavoidable, such as when a severely necrotic ovary falls apart.

Continued educational efforts targeted at emergency care providers, general surgeons, pediatric surgeons, and gynecologic surgeons about current treatment recommendations for adnexal torsion in young patients are needed, and collaborative care pathways should be encouraged (54). Adolescents are a unique population with specific needs; thus, special care for placement of ports and lower insufflation pressure may be indicated. Multispecialty collaboration is crucial to optimize care and ensure that minimally invasive detorsion with ovarian preservation is the standard treatment provided to adolescents with adnexal torsion.

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