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Review

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The evaluation, diagnosis and management of adnexal torsion in pediatric and adolescent patients

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ABSTRACT

Adnexal torsion is a surgically diagnosed gynecological emergency with 30% of cases occurring in females under the age of 20. The most common ovarian pathologies observed in adolescents with adnexal torsion are benign teratomas and benign functional ovarian cysts. However, in 46% of cases, torsed ovaries are normal, without a mass or cyst. The torsion of malignant ovarian masses is extremely rare in this population. Torsion often presents with sudden-onset, intermittent abdominal pain, nausea and vomiting. It should be noted that there are no sufficient clinical or imaging criteria available, and Doppler ultrasound alone is not a guide to clinical decision-making to confirm the pre-operative diagnosis of adnexal torsion. If ovarian torsion is suspected, prompt intervention with diagnostic laparoscopy is recommended to preserve ovarian and tubal function. In 50% of cases, adnexal torsion is not found during laparoscopy; however, other gynecologic pathologies are identified and treated. When adnexal torsion is detected, detorsion is recommended, regardless of ovarian appearance. The purpose of this review is to guide clinicians regarding the current management and ovarian-sparing surgery of adolescent and pediatric patients with adnexal torsion.

Keywords: Adnexal torsion, adolescent, laparoscopy, ovarian torsion

INTRODUCTION

Adnexal torsion is the rotation of any combination of a normal or pathological ovary, fallopian tube or a paratubal cyst around the infundibulopelvic or utero-ovarian ligaments. It is the fifth most common gynecological emergency. It is estimated that approximately five in every 100.000 females between the ages of 1 and 20 are diagnosed with adnexal torsion.[1] Moreover, females under the age of 20 account for 30% of all adnexal torsion cases.[2] Its incidence increases in girls over the age of ten, as the frequency of physiological and pathological masses increases due to hormonal changes and gonadal growth.[3] Adnexal masses more than 5 centimetres increase the likelihood of torsion.[4] The most common ovarian pathologies in adolescents with adnexal torsion due to ovarian mass are benign functional ovarian cysts and benign teratomas.[5] Malignant ovarian mass torsion is uncommon in this cohort.[3] In contrast to adnexal torsion in adults, 46% of pediatric and adolescent girls experience adnexal torsion involving the ovary without a mass or cyst.[6] Predisposing variables may include a relatively small uterus that provides greater space for the adnexa to spin on its axis, excessive laxity of the pelvic ligaments, or congenitally lengthy ovarian ligaments.[3] Sixty-four percent of torsions occur on the right side due to the presence of the descending colon on the left and the longer right utero-ovarian ligament compared to the left.[7] In the pediatric literature, isolated tubal torsions are rare, with occurrences that are nearly invariably linked to tubal disease, including paratubal cysts.[8] Early diagnosis and treatment are very important for the preservation of ovarian and tubal functions. However, due to non-specific symptoms, diagnosis is not always easy, and difficulties may be encountered in managing the process. If ovarian torsion is suspected, laparoscopy is recommended for diagnostic and therapeutic purposes. In this article, the current literature on the management of pediatric and adolescent patients with ovarian torsion, possible surgical problems and future expectations are reviewed.

METHODS

PubMed, Scopus, Google Scholar, MEDLINE, UpToDate and Cochrane databases were searched for this review. Medical Subject Headings (MeSH) terms for adolescent and pediatric populations up to 1996 were used: “ovarian torsion,” “adnexal torsion,” and “ovarian preservation.” Single case reports, inconsistent articles, and non-English language articles were excluded.

PATHOPHYSIOLOGY

When ovarian torsion occurs, it causes compression of the ovarian arteries, veins and lymphatic vessels. The number and degree of twisting affect the severity of the compression. Venous vessels are subject to greater compression than arterial vessels due to their thinner walls. Therefore, venous drainage is initially impaired. With continued arterial perfusion, the ovary enlarges and becomes oedematous. Then, with further compression, ovarian ischemia, necrosis, haemorrhage and peritonitis begin to develop.[9] However, sepsis is rare.[10]

Chronic adnexal torsion can lead to necrosis, loss of function, amputation of the ovary, pelvic adhesions, pelvic pain, and tubal obstruction.[11] It is unknown how long after symptom onset ovarian necrosis will develop. An observational analysis of 22 pediatric patients with ovarian torsion found no correlation between the time from symptom onset to surgical intervention and ovarian preservation.[12]

DIAGNOSTIC EVALUATION

It is important to keep in mind that there are no radiological or clinical criteria that are adequate to validate the preoperative diagnosis of adnexal torsion when evaluating adolescents who may have it.[13] The most typical clinical sign of torsion is abrupt, intermittent, non-radiating abdominal pain that is accompanied by nausea and vomiting. In 62% and 67% of patients, respectively, nausea and vomiting are recorded.[14] It is reported that nausea and vomiting are more common in pre-menarchal patients.[1] Abdominal tenderness has been reported in 88% of patients with adnexal torsion, and rebound and peritoneal symptoms have been reported in 12-27%.[14,15] An adnexal mass may be palpable.[16] Low grade fever is present in 2% to 20% of patients, and might indicate adnexal necrosis, especially when leucocytosis is present. Most patients present to the hospital within one to three days of pain onset. Infrequent accounts of pelvic pain lasting up to 210 days, however, have been reported in the literature; these could be instances of intermittent torsion.[17]

Transabdominal ultrasonography is the preferred imaging method for the detection of adnexal torsion, with 92% sensitivity and 96% specificity.[18] On ultrasonographic examination, the torsed ovary appears oedematous, large and heterogeneous compared to the other side, and its position may have shifted towards the front of the uterus.[16] Moreover, follicles may appear arranged at the periphery of the ovary due to oedema. This image is also seen in polycystic ovary syndrome, but the central stroma is echogenic; both ovaries have a similar appearance, and the patient has no pain. In addition, if there is a mass in the torsed ovary or tube, it can be visualised ultrasonographically.[19] In a torsed ovary, Doppler flow may be normal, reduced or absent. Doppler flow may be normal because the adnexa is not completely occluded, is intermittently torsed, or because there is collateral blood flow. Therefore, normal Doppler flow does not exclude the diagnosis of torsion. When making an evaluation, both ovaries should be examined and compared.[20] The "whirlpool sign" (a doppler ultrasonographic image) indicating twisting of the vascular peduncle has a sensitivity of 90% or more.[21]

When evaluating a patient for a differential diagnosis of abdominal pain, a computed tomography (CT) scan or magnetic resonance imaging (MRI) scan may often be performed. The results will be similar to those of an ultrasound.[22]

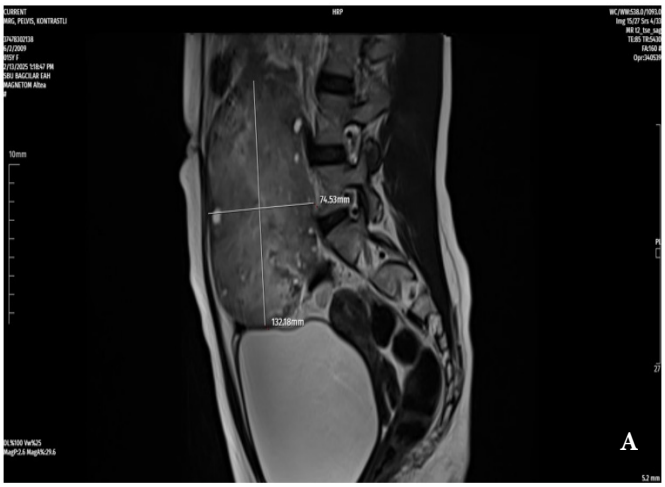
Adnexal torsion is diagnosed surgically.[4] In 50% of the cases with a preliminary diagnosis of adnexal torsion, adnexal torsion may not be detected during laparoscopy.[23] This negative result from laparoscopies is a clinically acceptable outcome considering the significance of ovarian preservation.

In girls around menarche, ruptured ovarian cysts and appendicitis should be kept in mind in the differential diagnosis.

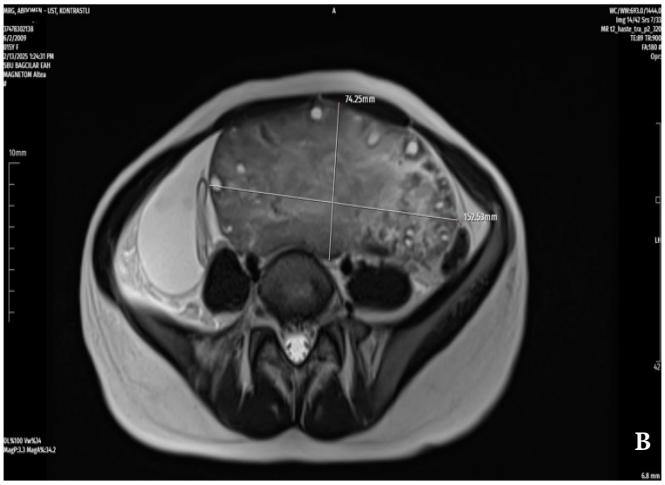
SURGICAL EVALUATION AND MANAGEMENT

Confirming torsion, evaluating ovarian viability, and correcting torsion are the objectives of surgical evaluation. A laparoscopic approach is recommended for surgical evaluation. Intraoperative assistance may be sought from a gynecologist experienced in detorsion and ovarian preservation.[24] Unless a malignant tumour is suspected, a torsed ovary should be considered viable as ovarian necrosis is very rare. There is no effective approach to determine ovarian viability and adequate perfusion during surgery. An enlarged and dark ovary may appear alarming to the surgeon, but it is still most likely viable. This appearance is usually due to congestion. It is best to endeavour to preserve the tube and ovary, accepting the possibility that the tube and ovary may not survive or may need to be removed at a later date. Previously, ovaries with this appearance were thought to be necrotic and non-viable. Because total arterial flow is presumably maintained at least partially in the torsed ovary despite venous and lymphatic congestion, numerous studies have shown that many patients retain ovarian function even after detorsion.[5,25-27] The lightening of the ovary colour after being detorsed is an indication that blood flow has improved. A 15-year-old adolescent patient, who underwent surgery 33 days later because her symptoms were intermittent and whose adnexal torsion diagnosis was made quite late, had normal ovaries on ultrasonographic imaging 2 months after surgery [**Figure 1 (1A,1B,1C,1D)**].

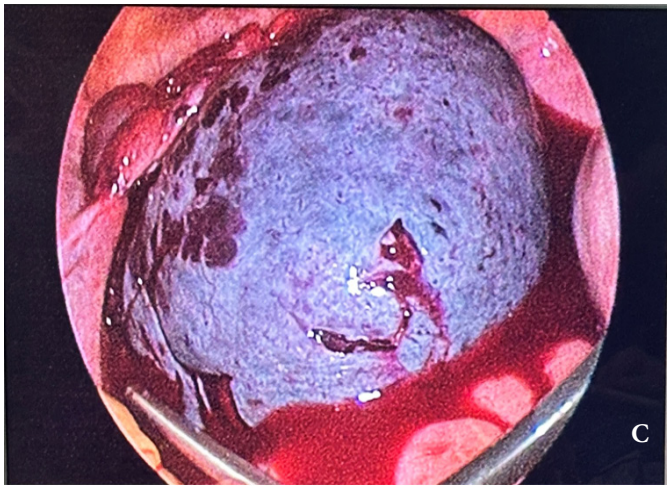
Previously, it was believed that ovarian preservation could lead to haemorrhage, peritonitis, abscess, infection, adhesion formation, or embolism.[28] Nevertheless, there is evidence that detorsion is not linked to these issues.[29] Despite increasing evidence of the safety and benefits of ovarian preservation, oophorectomy rates remain high in non-teaching hospitals.[30] Pediatric surgeons are primarily responsible for managing ovarian torsion in pediatric patients. Gynecologists and pediatric surgeons have different practice patterns, such that gynecologists are more likely than pediatric surgeons to perform ovarian preservation for torsion.[31] Aziz et al.[32] found that paediatric gynecologists performed 94% of ovarian detorsion surgeries, compared to 6% of pediatric surgeons in a single-institution sample of 34 patients.



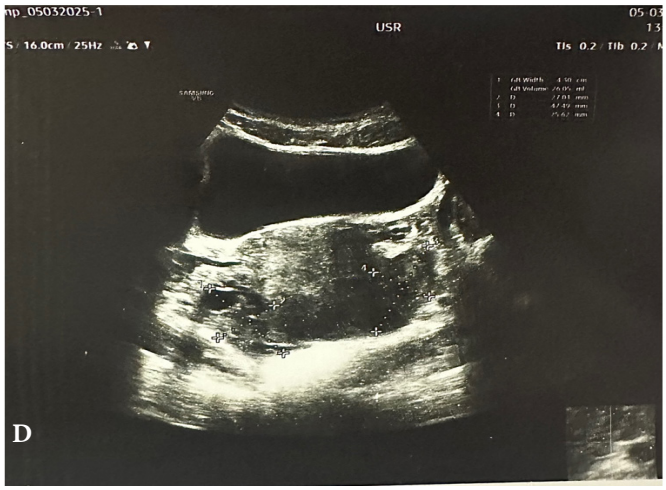
A. Sagittal section of the lesion identified on MRI



B. Transverse section of the lesion identified on MRI



C. Intraoperative laparoscopic image of the adnex rotated 5 times around itself



D. In the patient's second month postoperative evaluation, bilateral ovaries appeared normal with almost equal size on ultrasonography

Figure 1. Preoperative, intraoperative and postoperative images of a 15-year-old adolescent patient who underwent surgery 33 days later because her symptoms were intermittent and whose adnexal torsion diagnosis was made quite late. The patient's preoperative contrast-enhanced magnetic resonance imaging (MRI) revealed a well-circumscribed, T2-weighted, heterogeneously hyperintense, and T1-weighted, heterogeneously hypointense lesion extending from the pelvic inlet to the level of the umbilicus, measuring 152x132x74 mm. The lesion contained multiple millimeter-sized areas in the periphery, which were interpreted as follicles (Photographs are from Evrim Ebru Kovalak's archive).

The true incidence of malignancy in the pediatric population is uncertain, but concern for malignancy is often a driving factor in pursuing oophorectomy.[33] Because the torsed ovary is large and blue-black in colour, it may be difficult to assess the presence of any underlying malignancy.[2] In torsion case series where oophorectomy was performed, malignancy was detected in 0.4-5%.[34,35] Because of the risk of overlooking a hidden cancer, there is no evidence that oophorectomy is superior to detorsion. Oophorectomy should not be performed solely on the pretext of the possibility of malignancy. An oophorectomy needs to be contemplated only in cases where there is unambiguous clinical evidence of a malignancy.

Numerous studies have shown that ovaries with a blue-black colour due to torsion show follicle development on ultrasound follow-up after detorsion. Pathological examination of ovaries that underwent oophorectomy due to presumed complete necrosis has also revealed viable ovarian tissue.[36] Moreover, adult ovarian detorsion and preservation has been associated with successful pregnancies and live deliveries.[37] Since folliculogenesis after ovarian detorsion has been widely documented, ovarian conservation ought to be a top objective for surgery.

A recent systematic review of ninety-six studies found that ovarian detorsion was not associated with thromboembolic events. Infection caused by irreversible damage to a necrotic adnexa during conservative surgery appears to be a very rare condition.[34] Postoperative fever, worsening abdominal pain, peritoneal signs, and haemodynamic instability should alert the patient to the development of peritonitis or sepsis.

If a benign mass is present, cystectomy (if possible) or cyst drainage may be performed after detorsion. If oedema prevents cystectomy and there is concern that dissection may compromise vascular perfusion, the procedure is postponed until a second session. Patients with ovarian preservation should be followed with ultrasound 6-12 weeks after detorsion so as to confirm ovarian function and rule out any underlying mass or malignancy.[5]

Theoretically, salpingo-oophorectomy may be indicated in cases of a non-viable ovary that is clearly necrotic/gelatinous,

with a complete loss of all normal anatomic structures, or in cases of high suspicion of malignancy of the ovary or fallopian tube based on serum tumour markers and previous ultrasonographic findings.[38] In our own clinical practice, we perform ovarian-sparing surgery by detorsion all torsed ovaries unless the torsed ovary is spontaneously amputated.

PREVENTION OF RECURRENCE

Individuals who have already had ovarian torsion seem to be more susceptible to recurrence. The risk of recurrent torsion in pediatric patients is estimated to be between 2% and 12%.[5,39] Pre-menarchal patients with normal ovaries may be at higher risk of recurrent torsion than those with an ovarian mass. Recurrent torsion may occur in the same ovary or the other ovary. In cases of previous unilateral oophorectomy or asynchronous bilateral torsion, oophoropexy can be performed by shortening the utero-ovarian ligament during laparoscopic surgery.[40] However, there is concern about its routine use because the long-term outcomes of oophoropexy are not yet known.[9,13,35,41] Moreover, oophoropexy is not recommended when a mass is present.

The effect of suppressing ovarian cysts with low-dose oestrogen-progestin oral contraceptives in post-menarchal patients in preventing recurrent torsions is uncertain.[3]

CONCLUSION

In children and adolescents, ovarian detorsion and preservation should be the preferred treatment procedure for suspected ovarian torsion, with prompt intervention via diagnostic laparoscopy. Risks of detorsion, such as thromboembolic events, sepsis, and malignancies, are extremely rare. The benefits of oophoropexy following a single case of ovarian torsion have not been fully established. The surgeon should not remove a torsed ovary if oophorectomy is avoidable (such as when a severely necrotic ovary is ruptured).

ETHICAL DECLARATIONS

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The author has no conflicts of interest to declare.

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Author Contributions

The author declared that she participated in the design, execution, and analysis of the paper, and that she has approved the final version.

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