Review article

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# Premenarchal ovarian torsion

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Ovarian torsion is a common gynecologic emergency seen in women of all ages, mostly in reproductive women, resulting in ischemia and necrosis of the adnexal tissue. However, it is rare in premenarchal girls. This article reviews the limited published literature, and discusses special considerations about premenarchal ovarian torsion.

**Key words**: Laparoscopy; Menarche; Ovarian Torsion; Pediatrics; Ultrasonography, Doppler, Color

## Introduction

First described by Bland Sutton in 1890, ovarian torsion (OT) involves the twisting of the adnexa, including the fallopian tube or ovary[1]. A torsion causes venous compression, leading to ovarian edema and enlargement. If torsion persists, arterial blood flow becomes compromised, resulting in ischemia and necrosis of the adnexal tissue. OT is the fifth most common gynecologic emergency, accounting for 2.7% of all emergency gynecologic surgeries[2]. While most common in reproductive women, approximately 15% of OTs occur during infancy or childhood[2]. OT most commonly affects women aged 29–34 years, with an estimated incidence of 4.9 per 100,000 among women aged 1–20 years[3,4].

To date, the majority of publications describing OT in premenarchal girls have consisted of case reports and case series, primarily in the gynecologic and surgical literature[5–13]. This narrative review provides a summary of OT in children with a focus on premenarchal OT.

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## Main subject

### 1. Epidemiology and pathophysiology

While OT can occur in girls of any age, more than 50% of cases occur in those aged 9–14 years[12]. OT was found to be the cause of 1.3% of all non-traumatic abdominal emergencies evaluated in a pediatric emergency department[14]. Similarly to adults, the right ovary twists in 60% of children with OT while 40% occurring on the left[15]. It has been postulated that the right-side dominance is due to the sigmoid colon occupying the pelvic space on the left, or the hypermobility of the distal ileum and cecum on the right[16]. Asynchronous bilateral OTs in children have been reported[17].

Majority of the girls with OT are postmenarchal and subject to hormonal influences, predisposing them to developing an adnexal mass[7]. The presence of such a mass increases the likelihood of torsion since a heavy ovary is more likely to twist on its pedicle. The most frequent adnexal masses found with pediatric OTs are benign cystic teratoma and hemorrhagic or follicular cyst[6,16,18]. As with adults, the incidence of malignancy associated with OT in

children is quite low, with some studies reporting a 0% incidence of associated malignancy[8,18,19].

Premenarchal OT is less likely to be associated with an ovarian mass than postmenarchal OT, with some studies reporting over 50% of premenarchal OTs occurring in the structurally normal ovaries[9,10]. Possible factors associated with torsion of the normal ovary include an abnormally long ovarian suspensory ligament, increased venous congestion in the premenarchal period, previous gynecologic surgery, and abrupt changes in intraabdominal pressure from coughing or vomiting[9,12,16,20,21]. Premenarchal functional ovarian cysts, which predispose to OT, occur most frequently during the first year of life and around the time of menarche[16,22]. This is attributed to the lingering maternal hormones in the former period and the self-secreting hormones in the latter. These endocrinologic features explain the bimodal distribution of premenarchal OT, with the peak ages at infancy and at 12 years[23].

## 2. Presentation

Abdominal pain, usually described as having abrupt onset in the lower abdomen, is the presenting symptom in over 90% of pediatric OT (Table 1)[5,7-11,15,16,21,24,25]. Vomiting is the next most common symptom, occurring in the majority of pediatric patients[5,7,9,15,16,21,24,26].

**Table 1.** Frequency of manifestations with pediatric ovarian torsion

| Variable | Frequency, % |
|---|---|
| Symptoms | |
| Abdominal pain | 90-100 |
| Vomiting | 33-82 |
| Anorexia | 53 |
| Urinary symptoms | 8-14 |
| Diarrhea | 8 |
| Signs | |
| Abdominal tenderness | 61-95 |
| Palpable mass | 8-50 |
| Peritoneal signs | 27-47 |
| Fever | 4-22 |
| Abdominal distension | 10 |

Vomiting is more prominent in premenarchal girls than postmenarchal ones[9]. Approximately half of the patients report having had similar symptoms, indicating a possible previous torsion and detorsion[26,27]. Diagnosis of OTs in infants may be challenging in light of their nonverbal status. While not well-studied, most infantile OTs present with a groin mass and vomiting[28]. The symptom duration prior to presentation is typically longer than 24 hours, with premenarchal girls often having a significantly longer duration than postmenarchal ones[5,7,9].

On physical examination, majority of the patients have abdominal tenderness, with peritoneal signs present in less than half of them[7,9,15,21]. A palpable mass is present in up to 50%, and is more common in premenarchal girls[7,9,10,15,16,26]. Fever is present in a minority, and is also more common in premenarchal girls[5,7,9,10,16,21].

The presentation of OT in children frequently mimics other more common surgical emergencies, such as appendicitis and intussusception[28-30]. Not surprisingly, many diagnoses of OT in children are made during surgery for a possible appendicitis[31].

## 3. Evaluation

Serum white blood cell count has little value in the evaluation of possible OT in children, and is elevated in 38%-82% of cases[8,16]. In contrast, a C-reactive protein concentration higher than 5 mg/L was found to have an odds ratio of 12.3[32]. Approximately one-third of girls diagnosed with OT may undergo multiple imaging modalities before the diagnosis is made[33]. This is possibly driven by the fact that only approximately half of physicians suspect gynecologic diseases as the first presumptive diagnosis in cases of proven pediatric OT[30]. This percentage drops to one third in premenarchal girls[30]. Compared with postmenarchal girls, premenarchal girls with OT are more likely to obtain a delayed diagnosis, with a study reporting the delay in 38% of premenarchal girls compared with 20% in postmenarchal ones[12].

Doppler ultrasonography (US) has a reported 80% sensitivity and an 85%–95% specificity for adult OT[34]. For pediatric OT, the imaging modality has a 79% sensitivity and a 92% specificity[35]. Computed tomography has reported a 90%–100% sensitivity and an 85%–90% specificity, but it has a disadvantage of radiation exposure[34,36]. For this reason, US is considered the imaging modality of choice[15,36–39]. Magnetic resonance imaging has an 81% sensitivity and a 91% specificity, and has the advantage of no radiation exposure like US[37]. However, the use of magnetic resonance imaging is limited by availability and the frequent need for sedation in younger patients.

For sonographic diagnosis of OT, morphologic features are more important than the absence of arterial flow on Doppler images. Although transvaginal US is ideal for sonographic diagnosis, in reality, only transabdominal US is performed in most pediatric cases. The most common finding is an asymmetrically edematous ovary with an increased volume typically 3–4 times that of the contralateral ovary[40]. Irregular ovarian wall thickening and free fluid in the pelvis may also be seen[40,41]. In pediatric OT, an absence of Doppler flow is seen only in 38%–75% of cases[8–10,33,42,43]. This is likely due to the dual blood supply to the ovary from the ovarian and uterine arteries. Authors in both the pediatric and adult literature have concluded that Doppler flow alone cannot be relied on to diagnose or exclude the diagnosis of OT[41,45].

### 4. Treatment

Laparoscopic surgery is considered the best diagnostic and therapeutic modality for pediatric OT[35]. In 29%–80% of pediatric OTs, the diagnosis is suspected before surgery[7,8,18,27]. Premenarchal girls are significantly less likely to have a preoperative diagnosis of OT than postmenarchal ones[7]. Surgical management of pediatric OT has changed recently, with a shift from oophorectomy to ovarian detorsion with or without oophoropexy[8,43,46,47]. An ovarian salvage rate of 27%–99% in children has been reported with this more conservative approach[48]. Specifically in premenarchal girls, a 100% ovarian salvage rate was reported[49].

## Conclusion

Pediatric OT is rare, particularly prior to the menarche. Unlike postmenarchal OT, premenarchal OT frequently involves the structurally normal ovaries. The peak incidences of premenarchal OT are in infancy and just prior to menarche. Abdominal pain is the most common presenting symptom. Vomiting and palpable masses are often present, particularly in premenarchal girls. Pediatric OT is frequently misdiagnosed preoperatively as appendicitis. US is the imaging modality of choice, with an enlarged, edematous ovary commonly seen. An absence of Doppler flow is not universally present in pediatric OT. Laparoscopic surgery is considered the diagnostic and therapeutic modality of choice for pediatric OT.

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