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**Fetal ovarian cyst: 2- and 3-dimensional ultrasound as a new diagnostic method to rule out ovarian torsion**

**Abstract:** Owing to the improvement in obstetric ultrasound imaging, prenatal diagnosis of ovarian masses has increased considerably. Fetal ovarian cysts can be suspected when an ultrasound scan shows intra-abdominal structures in female fetuses in the presence of normal bowel and urinary structures. The most common complication is the adnexal torsion, causing partial or complete strangulation of blood supply via ovarian vessels, leading ovarian ischemia, or necrosis. Current information regarding the treatment of fetal ovarian cysts is based on personal experiences and some case series. The management is controversial, characterized by dissimilar approaches, such as “wait and see”, prenatal or postnatal aspiration, or neonatal surgery. In more than half of the cases, spontaneous regression occurs in the prenatal or postnatal period, probably due to the small size and simple aspect. Large cysts may cause both local effects (adnexal torsion, ovarian autoamputation), and distant effects (intestinal and urinary obstruction, adhesion with adjacent organs, abdominal and thoracic mass effect, pulmonary hypoplasia, hemoperitoneum, ascites, polyhyramniosis). In the absence of accurate guidelines for management, we must start with the development of more accurate methods for diagnosing associated complications such as torsion. This case report describes the role of three-dimensional (3-D) ultrasonography as potential diagnostic method for ruling out adnexal torsion when an ovarian cyst is present.

**Keywords:** Adnexal torsion; fetal ovarian cyst; prenatal diagnosis; three-dimensional ultrasonography.

**Introduction**

Ovarian cysts are among the most common abdominal masses in female fetuses, affecting around 1/2600 pregnancies [3]. In the last decades, due to the advent and the widespread use of routine sonography during pregnancy, the detection of fetal ovarian cysts has increased considerably [7]. The etiology of fetal ovarian cysts is still unknown, although a linkage with fetal gonadotrophin stimulation derived from maternal estrogens or placental human chorionic gonadotrophin (hCG) has been suggested. Cysts can arise from follicle epithelium, theca-lutein cells, corpus luteum, but some are without a known origin [12]. The question of malignancy plays virtually no role in prenatal diagnosis because fetal ovarian cysts are almost always functional and benign tumors [2]. Fetal ovarian cysts have been associated with pregnancies complicated by maternal diabetes, toxemia, and Rh isoimmunization, probably due to the increased production of hCG by the placenta and are rarely associated with other congenital anomalies [2, 4, 6, 12–14].

Various complications caused by fetal ovarian cysts have been described, such as compression of neighboring viscera, rupture of the cyst, hemorrhage, and adnexal torsion, causing ovarian loss [3, 12]. There is no standard treatment of fetal ovarian cysts, and their management varies widely among different centers, ranging from observation to intrauterine aspiration to neonatal surgery [2, 4, 6, 8, 12–14, 19].

From a diagnostic point of view, three-dimensional (3-D) ultrasonography has the potential to improve the visualization of fetal anatomy, including the recognition of structural abnormalities. Recently, Hata et al. applied an inversion mode for studying the relationship, size, and course of fluid collections in fetuses in the absence and presence of malformations, including fetal ovarian cysts, demonstrating the additional informative role of 3-D ultrasound [11].

We report a case of fetal ovarian cyst using 3-D ultrasound in order to show how a better definition of the relationship between the ovary containing the cyst and
its peduncle can be obtained and to introduce 3-D ultrasound as a method to rule out adnexal torsion when a fetal ovarian cyst is present.

**Case report**

A 33-year-old woman, gravid 1, para 0, was referred to our prenatal center for suspected fetal ovarian cyst. Previously, gestational age was confirmed by sonography in the first trimester. A normal karyotype was obtained by amniocentesis performed for maternal request. At 23 weeks, the ultrasound demonstrated a live female fetus without apparent structural abnormalities. At 30 weeks, the ultrasound organ system evaluation was normal, except for suspected ovarian mass in the left pelvis (Figure 1). A unilateral, solitary, and anechoic cyst, with a smooth border, but without an internal structure, located in the lower and left side of the fetal abdomen, measuring 24×17 mm, deprived of vascular signal, classified as “uncomplicated ovarian cyst”, according Nussbaum, was identified [16].

The patient was referred to our outpatient department at 31 weeks. Maternal risk factors for fetal ovarian cysts, such as maternal diabetes, toxemia, and Rh isoimmunization [2, 4, 8], were excluded. All hematologic and biochemical investigations were unremarkable. Ultrasound examinations were performed by a 4-MHz pulsed vector transducer using a color Doppler ultrasound with a high pass filter set at 100 Hz (Voluson E8, GE Healthcare Kretztechnik, Zipf, Austria). Standard biometric parameters (biparietal diameter, head circumference, abdominal circumference, femur length) were evaluated, and an estimated fetal weight (EFW) of 1980 g was calculated using the Hadlock formula [9]. The integrity of gastrointestinal and urinary tracts was confirmed. A normal amniotic fluid index (AFI) was calculated. Absence of ascites, as a possible result of transudation, as described in the literature [5], was confirmed. In the left pelvis, a unilateral cystic mass was detected, measuring 28×16 mm, with a fluid-debris level, septated, with solid contents, corresponding to the presence of liquid blood and an initial organized hematoma, suggesting a hemorrhagic functional cyst in the ovary (Figure 2). At our examination, the initial simple cyst became a “hemorrhagic cyst”, according to the ultrasonographic criteria proposed by Nussbaum [16]. Bleeding in association with fetal ovarian cyst raises the suspicion of adnexal torsion. A possible further sign of torsion is the fetal tachycardia, probably due to the peritoneal irritation [10], but in this case, fetal cardiac frequency was normal during the entire examination (146 beats/min, mean).

Unfortunately, we could not confirm or exclude the possible torsion by traditional exploration. Ovarian torsion could not be excluded by 2-D ultrasound. Three-dimensional ultrasound was attempted using different modes [rendering, tomographic ultrasound imaging (TUI), virtual organ computer-aided analysis (VOCAL), and angio-power Doppler] (Figures 3–6). Surface rendering and multiplanar scanning with x, y, and z axial rotation was performed. Our in-depth evaluation allowed two considerations: first, the cyst occupied almost the entire

![Figure 1](image1.png)  
**Figure 1** Fetal ovarian cyst, completely anechoic, classified as “simple cyst” by traditional ultrasound in according to the Nussbaum criteria during a routine scan at 30 weeks of gestation.

![Figure 2](image2.png)  
**Figure 2** Echogenic fetal ovarian cyst, identified by 2-D ultrasound at 31 weeks of gestation, suggestive of “complex cyst” with the presence of hemorrhage, in according to the Nussbaum criteria. Bleeding in association with a fetal ovarian cyst usually raises the suspicion of adnexal torsion.
ovary, and second, the ovarian peduncle seemed well preserved. In particular, the presence of continuity sign, defined as a “no-stop line”, tangent to the peduncle and parallel to its internal structures, revealed the absence of interruption of the anatomical elements located in the peduncle (Figure 3). TUI (or multislice imaging) is used in this case for defining more precisely the relationship between the ovary and its peduncle by analyzing the sequence of slices obtained (Figure 4). The 3-D mode seemed to confirm the results previously reported with rendering because there were no signs of interruption in the profile of the ovary-peduncle complex that might be suggestive of torsion. The volume of fetal ovarian cyst was measured (21.73 cm³), and all parameters of vascular flow (VI=15.65, FI=11.02, VFI=1.72) were calculated by VOCAL (Figure 5). Finally, 3-D high-definition flow imaging (3-D HDFI) was used to improve the detection of vascular anomalies such as torsion (Figure 6) [1].

In conclusion, all antenatal 2- and 3-D ultrasound evaluations suggested a hemorrhagic cyst without apparent signs of torsion. Because of the low risk of ovarian loss and consequential impact on future fertility, observational management was chosen in agreement with the parents. We established serial scanning once weekly until delivery.
Progressive dimensional reduction of hemorrhagic cyst (at 35 weeks, 22×11 mm) was shown over time.

The baby was born vaginally at 36 weeks of gestation. Birth weight was 2840 g, height 47 cm, head circumference 28 cm. Apgar scores were 9 and 10 at 1 and 5 min, respectively. Physical examination was unremarkable. Palpable mass in the abdomen was not appreciated. Hematologic and biochemical anomalies were excluded. An early postnatal scan (day 0) was performed. A cystic mass, hypoechoic lesion with round calcification of the cyst wall, measuring 17×6 mm in the left pelvis was detected. Some follicles in the left ovary were described, confirming our antenatal hypothesis of the absence of ovarian torsion, as reported in the literature [16]. Hormonal evaluation (estradiol, LH, FSH) and tumoral markers (AFP, BHCG, CEA, CA125, CA 19-9) were unremarkable. In consideration of these findings, the baby was discharged at 3 days of life. Long-term sonographic follow-up was available (at 1, 2, 3, and 4 months of life), showing a reduction of hemorrhagic cyst until its disappearance.

**Discussion**

Owing to the increased application of routine prenatal ultrasound, the detection of fetal abdominal anomalies has improved considerably [2, 6, 7, 12–14]. When a cystic abdominal mass is diagnosed in the female fetus, differential diagnosis should be established for mesenteric or urachal cysts, intestinal duplication anomalies, cystic teratoma, and intestinal obstruction, even though fetal ovarian cysts are among the most common abdominal masses in female fetuses [2, 3]. A complete etiology is still not completely known, although a possible linkage with fetal gonadotrophin stimulation derived from maternal estrogens or placental human chorionic gonadotrophin (HCG) has been suggested [13]. Many cysts have their origin in the follicle epithelium, but can also be theca-lutein, corpus luteum or simple cysts whose origin cannot be determined [3]. Fetal ovarian cysts have been associated with obstetric complications (pregestational diabetes,
preeclampsia, and Rh isoimmunization), probably due to the increased production of hCG [2, 6, 7, 12–14], and only rarely associated with other congenital anomalies [3].

In most cases, the size of the fetal ovarian cyst is small, without clinical significance and with spontaneous resolution [4]. However, some fetal ovarian cysts may present with complications, such as compression on the adjacent viscera, rupture, and hemorrhage [18]. Certainly, the most severe complication is represented by the cyst rotating around its axis, which may occur in 25–54% of fetal ovarian cysts [3, 6, 7, 12, 19], causing partial or complete strangulation of the blood supply via the ovarian vessels, and leading to ischemia or necrosis of the ovary. This may further produce autoamputation and ovarian loss [12]. Several studies have dealt with the management of fetal ovarian cysts, but no single protocol has been universally accepted, and so the issue remains a matter of controversy [2, 4, 6–8, 12–14, 19]. Prenatal management of fetal ovarian cysts is not clearly defined [2, 4, 6, 8, 13, 19]. It is suggested that large cysts should be aspirated due to the risk for torsion, but the cutoff (>40 or 50 mm) point for in utero aspiration is debated, as reported in several reports [2–9, 11–14, 16, 19]. Feto-amniotic shunting for cystic decompression is possible, but sometimes the cyst forms again, torsion occurs despite a reduction in cyst diameter, or postnatal surgery is necessary [2–4, 6–8, 10, 12–14]. In addition, a small risk of intracystic bleeding, infection of the amniotic cavity, and premature labor have been reported [2, 6, 4, 10, 12–14]. Consequently, limiting prenatal aspiration to cases that are very large or distend the fetal abdomen is prudent [3, 10].

The sonographic findings of a twisted ovary in the fetus include septation, debris, and homogeneous low-level echoes [16]. Nussbaum described as specific signs of torsion a fluid-debris level and retracting clot (ground glass). Muller-Leisse et al. found that uncomplicated cysts developed intraluminal echoes of varying morphology postnatally, attributed by the authors to mechanical stress of delivery and not to torsion [15]. Owing to the limitations of a traditional ultrasound approach, our aim was to define more accurately the relationship between the peduncle and the ovary using 3-D ultrasound in prenatal life. Similarly to radiological features identified in adulthood as suggestive of ovarian torsion (unilateral enlarged ovary, uniform peripheral cystic structures, coexistent mass within the affected ovary, free pelvic fluid, lack of arterial or venous flow, twisted vascular pedicle), we tried the same in fetal life [17]. In order to define if the vascular peduncle was normal or twisted, we worked on the 3-D images in offline modality. The most important evidence that we observed was the continuity of a line tangent to the peduncle, lateral to the ovary and mass, and parallel to the ovarian internal structures, called continuity sign (Figure 3), which suggests the absence of ovarian twisting. Analyzing the relationship between ovary and peduncle in TUI images, we confirmed their continuity without elements of torsion.

In conclusion, our report seems to contribute to available diagnostic testing when fetal ovarian cysts are present by adding the integrated 2-D and 3-D approach, including, importantly, the continuity sign that may suggest that ovarian torsion is not present.

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References


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