

# Daughter cyst sign

William Thoburn Randazzo<sup>1</sup>, Arie Franco<sup>1\*</sup>, Saudiqa Hoossainy<sup>2</sup>, Kristopher Neal Lewis<sup>1</sup>

1. Department of Radiology, Georgia Health Sciences University, Augusta, Georgia, USA

2. Department of Pediatrics, Georgia Health Sciences University, Augusta, Georgia, USA

\* **Correspondence:** Arie Franco, Department of Radiology, Georgia Health Sciences University, 1120 15th Street, Augusta, GA 30912, USA

(✉ [afranco@georgiahealth.edu](mailto:afranco@georgiahealth.edu))

Radiology Case. 2012 Nov; 6(11):43-47 :: DOI: 10.3941/jrcr.v6i11.1183

## ABSTRACT

The daughter cyst sign is a specific indicator of an uncomplicated ovarian cyst and pathologically represents a stimulated ovarian follicle. This finding must be differentiated from an ectopic pregnancy in a patient who has the potential to become pregnant. We report an uncomplicated ovarian cyst in a 3-year-old female with McCune-Albright syndrome and precocious puberty mimicking an ectopic pregnancy.

## CASE REPORT

### CASE REPORT

A 3-year-old female presented for a screening ultrasound of the kidneys and a right-sided cystic ovarian lesion was demonstrated with an internal cystic component. The patient is an ex-35 week premature female, with a prenatal diagnosis of a dysplastic left kidney, born to a mother with pre-eclampsia with a past medical history also significant for precocious puberty, café-au-lait spots, and fibrous dysplasia of McCune-Albright syndrome as well as a congenital nevus over the left side of her face and neck. The patient's bone age was approximately 11 months older than her chronologic age.

The patient was without abdominal symptoms at the time of our current screening ultrasound but had a history of vaginal bleeding, gynecomastia and body odor, which began one month following her second birthday. The left dysplastic kidney was not visualized. A right sided cystic ovarian lesion was demonstrated that measured 3.3 cm x 3.5 cm x 3.4 cm with internal peripheral cystic component measuring 7.0 mm x 6.5 mm x 7.0 mm and without internal color Doppler flow (Figures 1, 2, 3). This lesion resembled an ectopic pregnancy and as such, a beta human chorionic gonadotropin level was drawn. It was reported to be less than 5 mIU/dL, which was negative for pregnancy and the patient was followed conservatively.

### DISCUSSION

The differential diagnosis for a lower abdominal mass in a female child includes benign, malignant, and infectious etiologies of the ovaries, fallopian tubes, and uterus. Other differential considerations consist of an enteric duplication cyst, meconium pseudocyst, lymphangioma, anterior meningocele, mesenteric cyst, urachal cyst, and other renal cystic lesions [1,2]. Of note, the most common abdominal mass in the female newborn is ovarian in etiology [3] with malignant neoplasm reported in up to 3.5% of neonatal ovarian masses [4]. Obtaining the correct diagnosis is important as the clinical management varies widely depending on the etiology of the mass.

Cystic lesions of the ovary are not uncommon in the prepubescent population. In utero, there is normal stimulation of ovarian follicles by maternal hormones, resulting in ovarian cysts, which then involute when maternal hormonal stimulation decreases [5,6]. An ovarian follicle is a physiological maturing cyst of less than 20mm in diameter in the postnatal age group [7]. In one series, approximately 10% of healthy girls without signs of thelarche demonstrated ovarian follicles less than or equal to 10 mm in size [8].

Cystic ovarian lesions are commonly found in children with precocious puberty, resembling normal findings in post pubescent ovaries. There are two types of precocious puberty: central and peripheral. Central precocious puberty, known as

gonadotropin-dependent, is idiopathic in two-thirds of cases while being caused by central nervous system conditions in the other cases. Peripheral precocious puberty is gonadotropin-independent. Autonomous ovarian follicles are the most common cause of peripheral precocious puberty with estrogen-secreting neoplasms much less common [9,10].

Ovarian cysts in precocious puberty have been reported to range in size from 25 mm to 65 mm with normal contralateral ovarian size for the patient's chronological age. In addition, these patients demonstrated an enlarged, stimulated uterus measuring more than 35 mm in length [9]. Ovarian volumes in patients with precocious puberty have been reported as 4.1 to 4.6 cm<sup>3</sup>, while less than 1 cm<sup>3</sup> in other patients [11]. In the same series, ovarian cysts greater than 9 mm were found in peripheral precocious puberty. As such, cysts larger than 10 mm may be associated with hormone production and precocious puberty [12] with cysts greater than 10 mm not observed in one series of healthy girls between the ages of 1 and 13 [8].

Peripheral precocious puberty may be associated with cafe-au-lait spots and fibrous dysplasia, which is termed McCune-Albright syndrome. It is caused by a mutation in the GNAS1 gene resulting in activation of adenyl cyclase [12]. Ovarian cysts are common in McCune-Albright syndrome [13] with ultrasound typically demonstrating a unilateral follicular ovarian cyst [9,14,15].

To aid in diagnosing cystic masses in neonates, infants, and young children, the daughter cyst sign has been described as a specific indicator of an uncomplicated ovarian cyst. The reported sensitivity is 82%, specificity 100%, and positive predictive value 100% for predicting an ovarian etiology when the daughter cyst sign was present [2].

The daughter cyst sign describes a peripherally based cyst within a cyst. In one study, the size of the daughter cysts ranged from 2 mm to 8 mm with the number of daughter cysts ranging from 1 to 3 [2]. Quarello et al. identified the daughter cyst sign prenatally with daughter cysts measuring up to 18 mm in diameter [16]. Pathologically, the daughter cysts corresponded to ovarian follicles [2].

To the authors' knowledge, a daughter cyst sign has yet to be reported in a case of precocious puberty with only two cases reported in a young child [2]. Unique to precocious puberty is the real possibility of pregnancy and excluding an ectopic pregnancy is an important clinical consideration in a patient with an adnexal cystic mass.

Similar in appearance to a daughter cyst is a yolk sac within a gestational sac of pregnancy, which is also a peripheral cyst within a cyst. Pregnancy in children with precocious puberty has been reported in the literature [17]. Typically, ectopic pregnancies are tubal in location with ovarian-based ectopic pregnancy much less common [18]. Unlike an ectopic pregnancy, an uncomplicated ovarian cyst, as denoted by the daughter cyst sign, does not demonstrate a "ring of fire" sign, which is intense peripheral color Doppler

flow around the gestational sac. Additionally, a fetal pole or fetal heart tones may be noted in an ectopic pregnancy.

As opposed to ectopic pregnancy, an uncomplicated ovarian cyst may be followed conservatively with an excellent prognosis. However, ovarian cystic masses increase the incidence of ovarian torsion. The daughter cyst sign should also not be confused with an ureterocele, which has a similar sonographic appearance but is present in the posterior lateral wall of the bladder.

#### TEACHING POINT

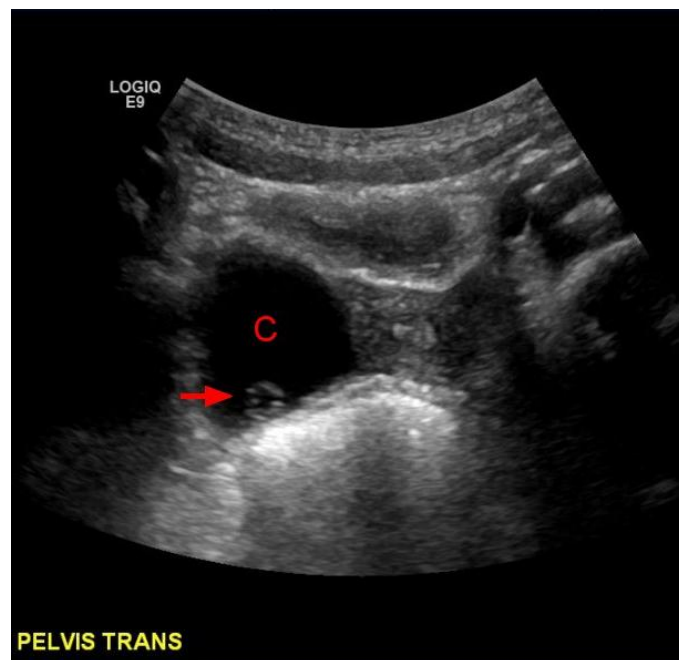
It is important to recognize the daughter cyst sign as a specific indicator of an uncomplicated ovarian cyst, as opposed to an ectopic pregnancy. It may be found in normal neonates and infants or in children with precocious puberty. However, in a patient with the potential to become pregnant, excluding an ectopic pregnancy is an important clinical consideration.

#### REFERENCES

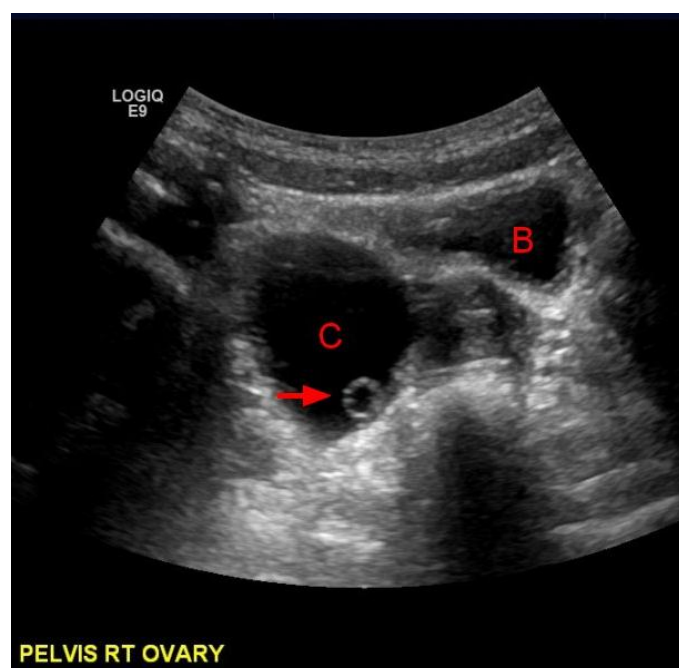
- Swishuk LE, John SD. Differential diagnosis in pediatric radiology, 2nd ed. Baltimore: Williams & Wilkins, 1995:146-148
- Lee HJ, Woo SK, Kim JS, Suh SJ. "Daughter cyst" sign: a sonographic finding of ovarian cyst in neonates, infants, and young children. *AJR Am J Roentgenol* 2000; 174:1013-1015. PMID: 10749241
- Heling KS, Chaoui R, Kirchmair F, Stadie S, Bollmann R. Fetal ovarian cysts: prenatal diagnosis, management and postnatal outcome. *Ultrasound Obstet Gynecol* 2002; 20:47-50. PMID: 12100417
- Henrion R, Helardot PG. In utero diagnosis of cysts of the ovary. *Ann Pediatr* 1987; 34: 65-69. PMID: 3548550
- Ikeda K, Suita S, Nakano H. Management of ovarian cyst detected antenatally. *J Pediatr Surg* 1988;3:432-435? PMID: 3288744
- Francis SA, Heazell AE, Chakravorty S, Rhodes C. Concurrent maternal and fetal ovarian cysts *Journal of maternal-fetal and neonatal medicine*. June 2010, 23-6, 555-557 PMID: 20156113
- Anthony EY, Caserta MP, Singh J, Chen MY, Adnexal Masses in Female Pediatric Patients, *AJR* May 2012 vol. 198 no. 5 W426-W431 PMID: 22528923
- Herter LD, Golendziner E, Flores JA, Becker E, Spritzer PM, Ovarian and Uterine Sonography in Healthy Girls Between 1 and 13 Years Old: Correlation of Findings with Age and Pubertal Status, *AJR* June 2002, 178 (6) 1531-6 PMID: 12034633

9. Rodriguez-Macias KA, Thibaud E, Houang M, Duflos C, Beldjord C, Rappaport R. Follow up of precocious pseudopuberty associated with isolated ovarian follicular cysts. *Arch Dis Child* 1999; 81:53-56? PMID: 10373136
10. Garel L, Dubois J, Grignon A, Filiatrault D, Van Vliet G, US of the Pediatric Female Pelvis: A Clinical Perspective, November 2001 *RadioGraphics*, 21, 1393-1407 PMID: 11706212
11. King LR, Siegel MJ, Solomon AL, Usefulness of ovarian volume and cysts in female isosexual precocious puberty. *JUM* 1993 (12)10, 577-581 PMID: 8246336
12. Schultz K, Ness K, Nagarajan R, Steiner M Adnexal Masses in Infancy and Childhood. *Clinical Obstetrics & Gynecology*: 2006 (49) 3 464-479 PMID: 16885654
13. Gesmundo R, Guanà R, Valfrè L, De Sanctis L, Matarazzo P, Marzari D, Lala R Laparoscopic management of ovarian cysts in peripheral precocious puberty of McCune-Albright syndrome. *J Pediatr Endocrinol Metab*. 2006 (19) 2:571-5 PMID: 16789619
14. Fakhry J, Khoury A, Kotval PS, Noto RA. Sonography of autonomous follicular ovarian cysts in precocious pseudopuberty. *J Ultrasound Med* 1988; 7:597-603 PMID: 3062186
15. Rieth KG, Comite F, Shawker TH, Cutler GB. Pituitary and ovarian abnormalities demonstrated by CT and ultrasound in children with features of the McCune-Albright syndrome. *Radiology* 1984 153:389-393 PMID: 6385106
16. Quarello E, Gorincour G, Merrot T, Boubli L, D'Ercole C. The 'daughter cyst sign': a sonographic clue to the diagnosis of fetal ovarian cyst. *Ultrasound Obstet Gynecol*. 2003 22(4):433-4 PMID: 14528483
17. Ehrhardt AA, Meyer-Bahlburg HF, Bell JJ, Cohen SF, Healey JM, Stiel R, Feldman JF, Morishima A, New MI. Idiopathic precocious puberty in girls: Psychosexual development. *J Am Acad Child Psychiatry*. 1984 Jan;23(1):23-33.PMID: 6693676
18. Dialani V, Levine D. Ectopic pregnancy: a review. *Ultrasound Q*. 2004;20:105-117 PMID: 15322388
19. Pham H, Lin E. Adnexal ring of ectopic pregnancy detected by contrast-enhanced CT. *Abdom Imaging*. 2007 Jan-Feb;32(1):56-8 PMID: 16947073
20. Tamai K, Koyama T, Togashi K. MR features of ectopic pregnancy. *Eur Radiol*. 2007 Dec;17(12):3236-46 PMID: 17882426
21. Kataoka ML, Togashi K, Kobayashi H, Inoue T, Fujii S, Konishi J. Evaluation of ectopic pregnancy by magnetic resonance imaging. *Hum Reprod*. 1999 Oct;14(10):2644-50 PMID: 10528001

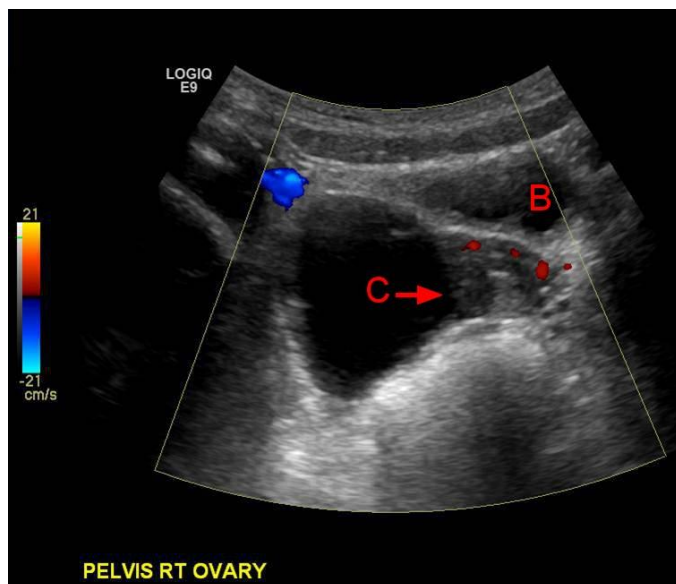
## FIGURES



**Figure 1:** 3-year-old female with precocious puberty and McCune-Albright syndrome. Sonogram of the pelvis performed with multi-frequency probe (GE sector 4-10) in transverse view demonstrates a right adnexal cyst (C) measuring 3.3 cm x 3.5 cm x 3.4 cm. A daughter cyst is seen (arrow) inside the large cyst measuring 7.0 mm x 6.5 mm x 7.0 mm.



**Figure 2:** 3-year-old female with precocious puberty and McCune-Albright syndrome. Sonogram of the pelvis performed with multi-frequency probe (GE sector 4-10) in longitudinal view demonstrates a right ovarian cyst (C) measuring 3.3 cm x 3.5 cm x 3.4 cm. A daughter cyst is seen (arrow) inside the large cyst measuring 7.0 mm x 6.5 mm x 7.0 mm. B - Bladder.



**Figure 3:** 3-year-old female with precocious puberty and McCune-Albright syndrome. Sonogram of the pelvis performed with multi-frequency probe (GE sector 4-10) in longitudinal view with color Doppler analysis demonstrates a right ovarian cyst (C) measuring 3.3 cm x 3.5 cm x 3.4 cm without peripheral or internal color Doppler flow. A small amount of color flow is noted in the right ovarian parenchyma. A daughter cyst is seen (arrow) inside the large cyst measuring 7.0 mm x 6.5 mm x 7.0 mm. B - Bladder.

<b>Etiology</b>	Ovarian stimulation or precocious puberty resulting in ovarian follicle formation
<b>Incidence</b>	Small studies report daughter cyst sign in 82% of ovarian cystic lesions in neonates, infants, and young children [7] and 25% of prenatal ovarian cysts [15]
<b>Gender ratio</b>	Exclusively female
<b>Age predilection</b>	Reported prenatally up to 36 months of age [7,15]
<b>Risk factors</b>	Stimulation in utero from maternal hormones, central precocious puberty, peripheral precocious puberty
<b>Treatment</b>	Conservative management with clinical follow up, must exclude ectopic pregnancy and other cystic abdominal masses
<b>Prognosis</b>	Excellent, however, increases likelihood of ovarian torsion
<b>Imaging features</b>	Peripherally based simple cyst within a larger simple cyst on US

**Table 1:** Summary table for daughter cyst sign

	US	CT	MRI
<b>Uncomplicated ovarian cyst</b>	-Peripherally based simple cyst within a larger simple cyst associated with the ovary -No increase in color Doppler flow	-Cystic ovarian lesion -Daughter cyst likely below resolution on CT	-Cystic ovarian lesion -High T2 signal intensity -Daughter cyst below MRI resolution
<b>Ectopic pregnancy</b>	-Peripheral cyst (yolk sac) within a larger echogenic cyst (gestational sac) -"Ring of fire" on color Doppler flow -Possible fetal pole associated with yolk sac -Fetal heart tones may be present -Possible free fluid in the abdomen and pelvis	-Ring enhancing cystic structure on contrast enhanced CT [19] -Possible hemoperitoneum or intraperitoneal free fluid	-Cystic sac-like structure -Low T2 intensity surrounding hematoma [20] -Enhancing tubal structure post contrast with tubal ectopic [20] -Hematosalpinx: low signal intensity on T2, intermediate on T1 [21]
<b>Ureterocele</b>	- Peripherally based simple cyst within the bladder - Associated ureteral jet on Doppler imaging	Posterior lateral cystic mass within the bladder	Posterolateral cystic lesion within the bladder following fluid signal intensity -Bright T2

**Table 2:** Differential diagnosis of the daughter cyst sign as demonstrated by various imaging characteristics

#### ABBREVIATIONS

CT = Computed tomography  
MRI = Magnetic resonance imaging  
US = Ultrasound

#### KEYWORDS

Daughter cyst; ovarian cyst; ovarian follicle; ectopic pregnancy

#### Online access

This publication is online available at:  
[www.radiologycases.com/index.php/radiologycases/article/view/1183](http://www.radiologycases.com/index.php/radiologycases/article/view/1183)

#### Peer discussion

Discuss this manuscript in our protected discussion forum at:  
[www.radiopolis.com/forums/JRCR](http://www.radiopolis.com/forums/JRCR)

#### Interactivity

This publication is available as an interactive article with scroll, window/level, magnify and more features.  
Available online at [www.RadiologyCases.com](http://www.RadiologyCases.com)

Published by EduRad



[www.EduRad.org](http://www.EduRad.org)