Case Report

Transition of ovarian granulosa cell tumor from a solid mass to a cystic mass in two months on MR imaging in an adult woman: A case report

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ABSTRACT

Ovarian granulosa cell tumor (OGCT) is a relatively rare ovarian tumor originating from ovarian sex cord-stromal cells. It is generally believed that the tumor is mainly a solid mass in the early stage, and with the volume increasing, the tumor would undergo multiple cystic changes. But few such cases have been reported. This article reports a case of transition of ovarian granulosa cell tumor from a solid mass to a cystic mass in 2 months on MR imaging in an adult woman. In this case, a 55-year-old postmenopausal woman underwent MR imaging for irregular vaginal bleeding in March 2022, during which a 6-cm cystic-solid mass was detected in the right ovary with iso-hypo intensity on T1WI, iso-hyper intensity on T2WI, and hyper intensity on DWI. After injection of the contrast medium, the mass displayed progressive and obvious enhancement, which was diagnosed as OGCT. Due to the COVID-19 pandemic, the patient was unable to receive surgery in time. Two months later, the patient returned to the hospital and underwent MRI again, when a 20-cm cyst mass was detected in the pelvis, which contained little solid component at the edge. The patient was admitted and underwent a total abdominal hysterectomy with bilateral salpingo-oophorectomy. The postoperative pathology confirmed the diagnosis of adult type stage IC1 OGCT. This finding may be precious in that it could help understand the initiation and progression of OGCT.

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Abbreviations: OGCT, Ovarian granulosa cell tumor; SCST, Ovary sex cord-stromal tumor.
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Introduction

Ovary granulosa cell tumor (OGCT) represents 90% sex cord-stromal tumors, accounting for about 2%-5% of all ovarian tumors [1]. OGCTs are divided into adult GCT (AGCT) and juvenile GCT (JGCT) based on different clinicopathological characteristics. The AGCT subtype represents 95% GCT, which can occur at any age and especially in perimenopausal or early postmenopausal women with a peak age incidence between 50 and 55 years [2]. Patients often present with osteogenic manifestations such as menometrorrhagia and post-menopausal bleeding, or underlying endometrial hyperplasia and/or adenocarcinoma in some cases.

The biology of GCT has not been well understood [3]. Most scholars believe that the tumor is mainly in the solid form in the early stage, and with the tumor volume becoming larger, the tumor undergoes multiple cystic changes [4,5]. To the best of our knowledge, only one study has reported the imaging features of OGCT dynamically.

Here, we report a case of AGCT which changed from mainly a solid mass to a cystic mass in 2 months as diagnosed by MRI and confirmed by surgery and histopathology.

Case report

A 55-year-old postmenopausal woman was referred to our hospital for irregular vaginal bleeding lasting for 1 month. The patient had no history of hormone administration and surgery. Laboratory tests showed that the associated tumor markers including SCC:0.8 ng/ml (<2.7 ng/ml), CA199:4.2 U/ml (<35 U/ml), CA125:4.1 U/ml (<6.9 U/ml), CEA:0.6 μg/L (<5.2 μg/L), AFP:4.3 μg/L (<7μg/L) and CA125:23.6 U/ml (<35 U/ml), which were within the normal range but the serum hormone levels were not measured. Pelvic MRI in March 2022 revealed a 6-cm cystic-solid mass in the right ovary, with iso-hypointense signal on T1WI, iso-hyperintense signal on T2WI, hyperintense signal on DWI, and hypointense signal on the ADC map with a mean ADC value of 0.65 × 10^{-3} mm²/s. After injection of the contrast medium, the mass showed progressive and obvious enhancement. In addition, the endometrium was unevenly enhanced (Fig. 1). Based on the above findings, a diagnosis of OGCT was made by the senior radiologists. However, the patient was unable to receive surgical treatment in time due to the COVID-19 pandemic in Shanghai, China.

Two months later, the patient returned to the hospital and underwent pelvic MRI scan again, when a 20-cm cyst mass was discovered, which covered the entire pelvic cavity and contained little solid component in the periphery. The cystic part of the tumor showed hypointense signal on T1WI, hyperintense signal on T2WI and hypointense signal on DWI, with the mean ADC value of 0.95 × 10^{-3} mm²/s. The solid component still showed obvious enhancement, which was consistent with that 2 months ago, and the surrounding structures were compressed and displaced (Fig. 2).

The patient had proceeded ultrasound and also revealed the change of volume (Fig. 3). Later, the patient was admitted and underwent a total abdominal hysterectomy with bilateral salpingo-ophorectomy. The omentum, pelvic peritoneal biopsy and pelvic lymph node specimens were obtained for pathological evaluation.

![Fig. 1](image1)

A 6-cm cystic-solid mass was detected in the right ovary by MRI. A mass was located in the right ovary (thin arrows), exhibiting iso-intensity on FS-T1WI (A), iso- and hyper-intensity on axial FS-T2WI (B), sagittal FS-T2WI (C), and coronal T2WI (D). The mass shows hyper-intensity on DWI (E), and contrast enhancement (F-H).
Grossly, a large cyst tumor with cyst fluid is pale yellow. The histopathology of the mass showed the right ovarian GCT (adult type), with microvascular invasion but with no tumor infiltration in the bilateral fallopian tubes, left ovary and uterine body, nor with tumor metastasis in the omentum, pelvic peritoneal biopsy and pelvic lymph nodes. Immunohistochemistry for the markers of GCT revealed the following: Inhibin (+), CD99 (partly +), Calretinin (partly +), CD10 (-), Vim (+), Des (-), EMA (-), and Ki67 (10%+) (Fig. 4). Adjuvant therapy was administered after surgery.

**Discussion**

Ovary sex cord-stromal tumor (SCST) consists of a heterogeneous group of neoplasms with diverse clinicopathological features and biological behavior. GCT constitutes 70% of SCST malignant tumor, derived from granulosa cells and somatic cells of the sex cords. The most common symptoms of GCT are vaginal bleeding and a palpable abdominal mass [6], which is consistent with the characteristics of our case. The mean tumor size of OGCT patients is 9.2-10.4 cm (range 0.2-40 cm), mostly affecting the unilateral side with a tendency of rightsided dominance [6,7].

Primary surgery is the mainstay of treatment for GCT and usually curative in the early stage of the disease. Surgical options include hysterectomy and bilateral salpingo-oophorectomy, following the performance of endometrial biopsy to rule out endometrial pathology. Lymph node dissection is of limited value, particularly in early-stage disease and is currently not recommended [8]. The role of adjuvant chemotherapy is debatable, for it has not been shown to improve survival rates, and is currently recommended only in those with advanced, recurrent or metastatic disease. Long-term surveillance including routine clinical follow-up and tumor markers (i.e. inhibin) serum evaluation is mandatory, as disease may recur remotely from the initial diagnosis [8]. Larger-sample clinical studies are required to settle these controversies.

Adult GCT is characterized by indolent behavior and a relatively good prognosis. In a retrospective study by Mangili et al. [9], the 5- and 10-year overall survival (OS) was excellent, offering a 97% and 95% rate respectively, and the 5- and 10-year disease-free survival rate was 91.8% and 71.6%, respectively. However, recurrences have been reported even 30 years after initial surgery, underpinning the importance of long-term follow-up observation [10,11].

To the best of our knowledge, few studies have reported the imaging features of the tumor growth and development of OGCT. MRI is closely related to the pathology, among which T2WI can reflect the pathological basis. In this case, the tumor showed mainly a solid mass in the early stage, with iso-intense signal on T2WI, and the cyst presented a "hive" change with hyperintense signal on T2WI. With the tumor volume increasing, the swelling growth of the tumor pushed and squeezed the adjacent tissues, and then the tumor gradually underwent a cystic change with hyperintense signal on T2WI, which is consistent with the literature [4]. It is worth noting that the solid mass had hyperintense signal on DWI and a low

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**Fig. 2** - A 20-cm cyst mass was detected on pelvic MRI 2 months later. The cyst mass exhibits hypointensity on FS-T1WI (A), and hyperintensity on FS-T2WI (B), sagittal FS-T2WI (C), and coronal T2WI (D). A little solid component was found in the periphery, which shows hyper-intensity on DWI (E), and contrast enhancement (F-H).
Ultrasound findings in different time points of the mass. The mass showed mixed echoes, with a clear boundary, and uneven internal echoes at first, and the mesh-echolic zone was visible (A). Two months later, the mass showed a dominantly anechoic mixed zone.

Representative H&E and IHC staining of the mass. Granulosa cell tumors have small cells with little cytoplasm. Tumor cells have less atypia and little mitosis (A, ×100). There are multiple large and thick blood vessels around the tumor (B, ×200). Ki 67 shows 10% of the nucleus with deep staining (C, ×100). The inhibin-stained cytoplasm is blue (D, ×100).
ADC value. Reportedly, ovarian signals become physiologically reduced on both T2WI and DWI after menopause because of atrophy, decreasing follicles and increasing numbers of stromal cells. Therefore, any high-intense signal on DWI in the postmenopausal ovary should be highly suspected as a malignant ovarian neoplasm, regardless of its size [12].

GCTs are commonly associated with high levels of estradiol and symptoms associated with elevated levels of estrogen, such as uterine bleeding [13]. Estradiol can stimulate the expression of vascular endothelial growth factor (VEGF) and its receptors [14,15]. As a cell factor that mainly regulates vasogenesis, VEGF plays an important role in cancer development [16,17]. So, a large amount of neovascularization can be produced in OGCT upon stimulation of high-level estrogen. Unlike blood vessels in normal tissues, neovascularization can form large numbers of arteriovenous fistulas. Therefore, the tumors were intensified in all enhanced stages, knowing that enhancement of the lesion can reflect the blood supply of the OGCT [3]. High-level estradiol stimulates endometrial hyperplasia as represented by thickening g of the endometrium on MRI.

This case report has some weaknesses in the process of diagnosis and treatment. Firstly, the serum estradiol hormone levels of the patient were not tested before surgery. In addition, tumor markers such as CA125 and the molecular testing such as FOXL2 mutation were not tested, which might be a useful tool in the diagnosis of GCT-adult.

**Conclusion**

OGCT presents as a solid mass in the early stage, and then undergoes multiple cystic changes with the volume becoming larger. In this case report, we described the transition of OGCT from mainly a solid mass to a cystic mass in 2 months from the initial MR imaging. This finding may be valuable in that it could help understand the growth and progress of OGCT.

**Patient consent**

The authors have obtained written informed consent for publication from the patient.

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