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# Fertility-sparing treatment for a giant borderline ovarian tumor in an adolescent: a case report

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**Abstract.** Borderline Ovarian Tumors (BOTs) are common ovarian epithelial tumors with biological behavior between benign and malignant lesions. The annual incidence of BOTs is approximately 4.5 per 100,000 population, which increases with age, starting from the 15–19 age group and peaking at 55–59 years. However, BOTs occurring in adolescents accompanied by giant tumors have a relatively low incidence and are rarely reported in the literature. This article reports the clinical diagnosis and treatment process of a 14-year-old adolescent with a giant borderline ovarian tumor complicated by ovarian pedicle torsion. The clinical features, intraoperative management and postoperative outcomes were reviewed, and the key points of diagnosis and treatment of this disease were analyzed in combination with relevant literature, so as to improve clinicians' understanding of this disease. At present, fertility-sparing surgery is the main treatment modality for BOTs patients with fertility needs. Postoperative chemotherapy and other supplementary treatments are not routinely recommended, and long-term follow-up is required after surgery.

**Keywords:** ovary, borderline tumor, fertility preservation, adolescent, case report

## 1. Introduction

Borderline Ovarian Tumors (BOTs) are ovarian epithelial tumors that lie between benign and malignant lesions, with generally favorable prognosis. They mostly occur in middle-aged women, while cases in adolescents with giant tumors and pedicle torsion are relatively rare. Clinical management requires both complete assessment of tumor risk and full consideration of fertility function protection for patients, posing certain challenges to diagnosis and treatment decision-making. This article reports the clinical diagnosis and treatment of a 14-year-old adolescent with a giant borderline ovarian tumor combined with ovarian pedicle torsion, reviews its clinical features, intraoperative management and postoperative outcomes, conducts a retrospective analysis of relevant literature on the diagnosis and treatment key points and therapeutic regimens for adolescent patients with borderline ovarian tumors, and summarizes how to select the optimal treatment plan for adolescent female patients with borderline ovarian tumors.

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## 2. Study methods

### 2.1. General information

The patient, a 14-year-old female, was admitted to Zhuhai People's Hospital on October 27, 2024 due to "progressive abdominal distension for 3 months, abdominal distension and poor appetite for 1 week". She began to feel progressive abdominal distension 2 months prior, with no other discomfort, which was initially attributed to weight gain and not taken seriously. One week before admission, she developed abdominal distension and poor appetite, accompanied by lower abdominal bearing-down sensation and mild abdominal pain. Her food intake decreased by about half compared with before, and defecation reduced with constipation, once every 2 days. She then visited a local hospital, and CT examination showed a cystic density shadow of 283 × 159 × 397 mm in the abdominal cavity, which was considered as right adnexal cystadenoma. For further diagnosis and treatment, she came to the outpatient department of our hospital and was admitted with the preliminary diagnosis of "ovarian mass of unknown nature". The patient had been healthy previously, denied surgical history and allergy history, had regular menstruation, and her last menstrual period was October 18, 2024.

### 2.2. Admission physical examination

The body weight on admission was 67 kg. Vital signs were stable, and no abnormalities were found in cardiopulmonary examination. The whole abdomen was distended with an abdominal circumference of 98 cm, larger than that of full-term pregnancy, and the abdominal wall tension was high. Gynecological specialist examination: normal vulvar development. Digital rectal examination: the uterus and bilateral adnexa in the pelvis were not clearly palpable; a cystic mass was felt in the pelvis, without tenderness, with smooth surface; cervical structure was palpable with normal size.

### 2.3. Auxiliary examinations

Auxiliary examinations were completed after admission. Ultrasound showed a huge cystic mass in the abdominopelvic cavity, considered to be of ovarian origin. CT showed a huge cystic space-occupying lesion in the abdominopelvic cavity, sized approximately 377 mm × 215 mm × 290 mm, considered as a neoplastic lesion originating from the right adnexa, possibly cystadenoma. Right renal pelvis and ureteral hydronephrosis were observed, possibly caused by compression of the middle and lower segment of the right ureter. Tumor markers showed: CA125 99 U/mL, while AFP, CA199, HE4, SCC and CEA were all within normal levels.

### 2.4. Diagnosis and treatment course

After admission, the patient's abdominal circumference increased progressively, with persistent fever of unknown origin, and no infectious symptoms of the nervous system, respiratory system, digestive system or urinary system. A series of infection indicators were all negative. White blood cells and neutrophils were normal. CRP was 121.6 mg/L, Erythrocyte Sedimentation Rate (ESR) was 87 mm/h, and Procalcitonin (PCT) was normal. After anti-infection treatment with cefazolin sodium 2.0 g q12h, the body temperature still did not decrease. To clarify the next diagnosis and treatment plan, the hospital organized one multidisciplinary consultation including gynecology, anesthesiology, infectious diseases department, hematology department, nutrition department, cardiology department, ICU and radiology department to evaluate the patient's condition. After discussion, all departments agreed that the patient was a minor female, the huge space-occupying lesion in the abdominopelvic cavity was most likely of ovarian origin with unknown nature. The patient had

recurrent high fever after admission, which was considered to be caused by excessive tumor burden or intratumoral infection. Active surgical treatment was required to reduce the tumor burden. After excluding surgical contraindications, surgical treatment was performed on October 31, 2024.

## 3. Results

On the day of surgery, the abdominal circumference was 101 cm (Figure 1), an increase of 3 cm compared with admission. During laparotomy, a huge ovarian mass occupied the abdominopelvic cavity, reaching up to the subxiphoid region, bilaterally to the midaxillary line, and inferiorly to the pelvic floor. A purse-string suture was made on the cortical surface of the ovarian mass, a puncture hole was made at the center, and about 10,000 mL of light brown cystic fluid was aspirated. Exploration revealed that the mass originated from the left ovary, with an overall diameter of about 40 cm, presenting as multilocular cystic. About 20×15 cm of purulent coating-like substance was attached to the surface of the ovarian cortex, with rough and sticky surface, and a local 6 × 5 cm erosive surface without rupture (Figure 2). The left ovarian blood vessels, fallopian tube and mesosalpinx were twisted 180 degrees. The left fallopian tube was thickened, elongated and edematous, sized about 15 × 5 × 4 cm, with normal surface color. On cut section of the mass, the cyst wall was locally rough and thickened, with scattered flaky yellowish-brown sticky elevations inside; multiple cystic cavities were seen, some containing clear fluid and some containing brown viscous fluid with foul odor. Intraoperative frozen section pathology report: (Left ovarian cyst) preliminarily considered as mucinous tumor with local epithelial hyperplasia; it could not be determined by frozen section whether the hyperplasia exceeded 10%, and borderline mucinous tumor could not be excluded. After informing the family members of the intraoperative situation, pathological results and related risks, considering the patient's future fertility needs, the family members requested to preserve part of the normal cortical structure of the affected ovary and reduce the torsion of the affected adnexa at the same time. Postoperative pathology report: (Left ovarian cyst) borderline mucinous tumor of the ovary, with local cyst wall necrosis accompanied by massive pus cell infiltration, and local dilated hemangioma-like structures (Figure 3). The patient was in good general condition after surgery. The body temperature dropped to normal on the first postoperative day, and the patient was discharged on the third postoperative day.

**Figure 1.** Appearance of the abdomen on the day of surgery

**Figure 2.** Intraoperative gross specimen

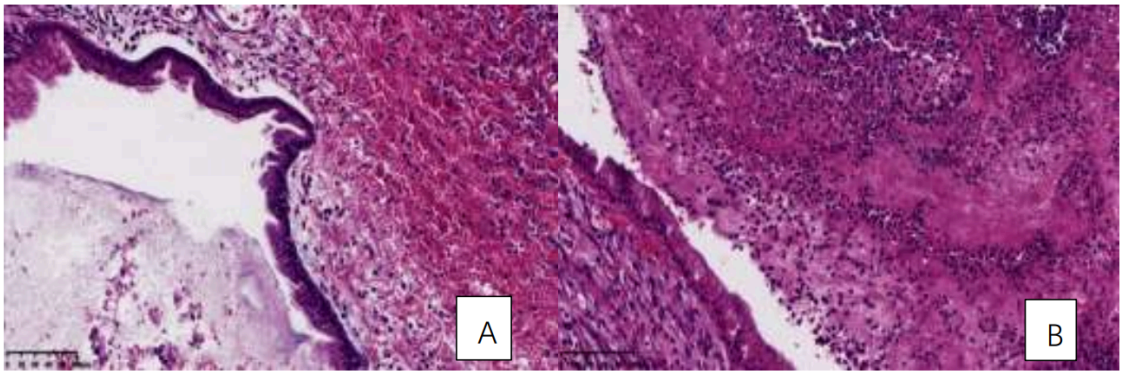


**Figure 3.** Postoperative pathological images. A. Borderline tumor (20×), HE staining. B. Necrotic and purulent cell regions (20×), HE staining

## 4. Discussion

Borderline Ovarian Tumors (BOTs) are common ovarian epithelial tumors with biological behavior between benign and malignant lesions. The annual incidence of BOTs is 1.8–4.8 per 100,000 population, and one third of cases affect premenopausal women [1]. Their clinical features are slow growth and rare recurrence and metastasis; microscopic features show active proliferation of epithelial cells without obvious stromal invasion. BOTs have favorable biological behavior; although the recurrence rate is high, the 5-year and 10-year survival rates can reach 95% and 90% respectively [2]. BOTs with giant volume and onset age under 20 years old are relatively rare in clinical practice.

The clinical manifestations of BOTs are non-specific. About 30% of patients often have no symptoms, and pelvic or abdominal masses are only found incidentally during gynecological examination or gynecological ultrasound [2]. As the tumor grows, digestive system symptoms, lower abdominal mass and compression symptoms may appear, and a small number of advanced patients have ascites. If the tumor ruptures or undergoes pedicle torsion, it may present as acute abdomen symptoms. In this case, the patient had no specific clinical manifestations at first, and then the abdominal circumference increased progressively. On admission,

the abdominal circumference had reached 98 cm, and compression symptoms had appeared due to the increased abdominal circumference. Only 4 days from admission to the day of surgery, the abdominal circumference increased by 3 cm, accompanied by mild abdominal pain, fever and other clinical manifestations. For the increase of tumor size in a short time, tumor malignant transformation, tumor infection, tumor torsion and other reasons are generally considered. In this case, 180-degree torsion of the fallopian tube and its surrounding blood vessels and tissues was found during surgery, a purulent coating-like substance of about 20 × 15 cm was seen on the gross specimen, and a large number of pus cells were found in postoperative pathology. This explains the reason for the accelerated increase of abdominal circumference and persistent fever in a short period after admission: it may be due to partial pedicle torsion of the ovarian tumor, which leads to obstruction of venous return, congestion and edema in the ovarian tumor, increased volume, and secondary infection after ischemic necrosis of tumor tissue, which in turn causes persistent fever in the patient.

Due to the atypical symptoms and the similarity of most clinical and imaging features to benign tumors, it is generally difficult to accurately determine the surgical scope preoperatively, and the surgical method is mainly determined by intraoperative frozen section pathology.

However, the accuracy of intraoperative pathology is generally related to the size of the tumor and the experience of pathologists. The accuracy of frozen section diagnosis for mucinous ovarian tumors is generally significantly lower than that of other histological types, because mucinous ovarian tumors are larger than other histological types, and the limited time for intraoperative frozen section sampling, section preparation techniques and other factors make frozen sections have limitations [3, 4]. In this case, the intraoperative frozen section pathology could not clarify whether the local epithelial hyperplasia exceeded 10% due to time constraints, and borderline tumor could not be excluded. The postoperative pathology result of borderline mucinous tumor of the ovary also reflects this limitation of intraoperative frozen section pathology. Some scholars believe that for young patients with fertility needs, if the frozen section does not clarify the degree of malignancy, conservative surgery should be performed as much as possible to give patients hope, and then subsequent supplementary treatment can be determined according to the final paraffin section [5]. In this case, the intraoperative frozen section pathology report of the mass: (Left ovarian cyst) preliminarily considered as mucinous tumor with local epithelial hyperplasia; it could not be determined by frozen section whether the hyperplasia exceeded 10%, and borderline mucinous tumor could not be excluded. After informing the family members of the intraoperative situation, pathological results and related risks, considering the patient's future fertility needs, the family members requested to preserve part of the normal cortical structure of the affected ovary, so only ovarian cystectomy was performed.

Fertility-Sparing Surgery (FSS) has always been the preferred surgical method for BOTs patients with fertility needs. FSS refers to preserving the uterine body and at least one ovary and fallopian tube to ensure natural pregnancy; or when the tumor involves both ovaries macroscopically or the risk of bilateral spread is high, bilateral fallopian tubes and ovaries are removed while only the uterus is preserved. FSS has a positive impact on patients' fertility, psychological expectation and quality of life. At present, NCCN, ESGO-ESHRE-ESGE and BGCS guidelines allow the use of FSS for BOTs at any FIGO stage, while invasive BOTs are classified as LGSC for treatment [6, 7]. For bilateral serous and serous/mucinous borderline ovarian tumors, bilateral ovarian cystectomy can be performed while preserving macroscopically healthy ovarian tissue. For unilateral serous and serous/mucinous borderline ovarian tumors, unilateral adnexectomy or ovarian cystectomy with preservation of macroscopically healthy ovarian tissue can be performed. If the patient only chooses cystectomy, the risk of local recurrence and ovarian recurrence can reach 30%, but this does not affect the overall survival rate, and patients can obtain better fertility outcomes [7]. A number of large-scale

retrospective analyses have also shown that compared with radical surgery, FSS may be associated with an increased recurrence rate. However, in terms of overall survival rate, there is almost no significant difference between the two treatment methods [8, 9]. Retrospective analyses have further confirmed that FSS is feasible in children and adolescent patients [10]. Borderline ovarian tumors are not sensitive to radiotherapy, chemotherapy and other means. At present, there is no data showing that postoperative chemotherapy or targeted therapy can improve the prognosis of patients, even patients with advanced disease or residual lesions cannot benefit from radiotherapy and chemotherapy.

Long-term regular follow-up after surgery is crucial for BOTs patients treated with FSS. Because BOTs have a tendency of late recurrence, the current Chinese expert consensus recommends that the follow-up time should be at least 10 years. Generally, the recommended follow-up contents include gynecological ultrasound and tumor markers; other imaging examinations can be selected individually. It is recommended to follow up every 3–6 months in the first 5 years, and once a year thereafter [2]. Generally speaking, tumor markers have important reference value in the prognosis and classification of borderline tumors. Serum CA125 elevation is more common in patients with S-BOT, while serum CA199 elevation is more common in patients with M-BOT [2]. However, the positive tumor markers in this patient are different from the previously reported conclusions: in this case, CA199 was at normal level, while CA125 level was elevated. Tumor markers elevated preoperatively are recommended as indicators for follow-up monitoring. The patient underwent reexamination of gynecological ultrasound and tumor markers at 1 week, 3 months, 6 months and 16 months after surgery, respectively, and no abnormalities were found.

## 5. Conclusion

In summary, fertility-sparing surgery is currently the main treatment modality for BOTs patients with fertility needs. Postoperative chemotherapy and other supplementary treatments are not routinely recommended, and long-term follow-up is required after surgery. This patient is in the special period of adolescence, and giant tumors and adolescent BOTs are relatively rare. Most patients and their families ignore the necessity of gynecological physical examination due to the young age of the patients. At the onset of the disease in this case, the family members did not pay attention and mistakenly believed that the progressive abdominal distension was caused by weight gain. This resulted in an abdominal circumference as large as full-term pregnancy on admission, making the choice of surgical approach passive and only laparotomy could be selected. If the patient had regular physical examinations and parents paid timely attention, the condition might have been detected earlier, and laparoscopic surgery could have been a perfect solution. Parents should be called on to pay more attention to the physical and psychological conditions of adolescents in this period and conduct regular routine physical examinations. At present, there are few reports of giant BOTs in adolescents, and this case is complicated by fallopian tube torsion. Further follow-up of the patient is required in the future.

## Ethical statement

This study involving human participants was conducted in accordance with the ethical standards of the Declaration of Helsinki and was approved by the Ethics Committee of Zhuhai Clinical Medical College of Jinan University (Approval Number: (2026) Lun Shen [Yan] No. 35. Written informed consent has been waived).

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