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Application of Frozen Section During Cesarean Delivery in a Woman with Mature Teratoma: a Case Report

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Abstract

Introduction. Ovarian dermoid cyst (teratoma) is more common during reproductive age. As we did not find enough information about the frozen section examination during Caesarean section in large-sized teratomas in the scientific sources we researched, we believe that the case we will present may be of theoretical and practical importance for clinicians.

Materials and methods. We would like to report a case in which a mature ovarian teratoma was detected during a Caesarean section in a 19 year-old pregnant woman with an asymptomatic large serous cystadenoma diagnosed during antepartum ultrasound examination. At the 37th pregnancy, the patient was admitted to our clinic due to labor pains. A live boy weighting 3380 g, length – 49 cm (Apgar scale – 7/8 points) was delivered by Caesarean section. A mature teratoma was detected during the puncture of the cystadenoma for frozen section examination. A frozen section examination of the cyst fluid ruled out malignancy. A left-sided adnexectomy was performed. After operation the diagnosis of mature teratoma was histologically confirmed.

Conclusions. Ultrasound examination may not be sufficiently informative in the diagnosis of mature ovarian teratomas during pregnancy. Performing a frozen section during the surgery determines the extent of the surgical procedure. This surgical tactic can prevent not only recurrent process, but also malignancy of large ovarian teratomas.

Keywords: frozen section, cesarean delivery, mature ovarian teratoma

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Применение экспресс-биопсии во время кесарева сечения у женщины со зрелой тератомой: описание клинического случая

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Резюме

Введение. Дермоидная киста яичника (тератома) чаще встречается в репродуктивном возрасте. Поскольку в изученных нами научных источниках не нашлось достаточно информации о срочном гистологическом исследовании крупных тератом во время кесарева сечения, мы считаем, что представленный нами случай может иметь теоретическое и практическое значение для врачей.

Материалы и методы. У 19-летней беременной женщины во время кесарева сечения была обнаружена зрелая тератома яичника с бессимптомной крупной серозной кистаденомой, диагностированной при дородовом ультразвуковом исследовании. На 37-й неделе беременности пациентка поступила в нашу клинику в связи с родовыми болями. В результате кесарева сечения родился живой мальчик весом 3380 г, ростом 49 см (по шкале Апгар – 7/8 баллов). Зрелая тератома была обнаружена при пункции кистаденомы для срочного гистологического исследования. Экспресс-гистологическое исследование жидкости кисты исключило злокачественность. Была выполнена левосторонняя аднексэктомия. После операции диагноз зрелой тератомы был гистологически подтвержден.

Выводы. Ультразвуковое исследование может быть недостаточно информативным при диагностике зрелых тератом яичников во время беременности. Проведение экспресс-биопсии во время операции определяет объем хирургического вмешательства. Эта хирургическая тактика может предотвратить не только рецидив, но и злокачественное перерождение крупных тератом яичников.

Ключевые слова: экспресс-биопсия, кесарево сечение, зрелая тератома яичника

■ INTRODUCTION

Adnexal tumors are common during pregnancy. Wide use of ultrasound methods during pre- and antenatal care leads to their earlier detection. Mature cystic teratomas originate from primordial germ cells and are composed of well-differentiated derivatives of any combination of the three germ layers: ectoderm, mesoderm, and endoderm.

Ectodermal elements usually predominate. Although they are generally benign, on rare occasions they may undergo malignant transformation in one of the elements, with squamous cell carcinoma being the most frequent malignant histology [1].

Thus, the frequency of adnexal tumors during pregnancy is estimated as 0.2–2% depending on the stage of pregnancy [2]. During pregnancy, it is possible for adnexal masses to spontaneously resolve without medical intervention, but sometimes situations requiring urgent surgical intervention may arise. These include ovarian torsion (1–22%), cyst rupture (0–9%), birth canal obstruction (2–17%), and at the same time they carry the risk of malignancy [3]. Notably, a large proportion of these tumors are typically considered benign based on their anatomical and pathological characteristics. Currently, an increasing number of studies emphasize the importance of frozen section analysis for the intraoperative evaluation of cystic masses. This technique not only guides the extent of surgical intervention but also facilitates fertility preservation in young women. Historical accounts in literature, often referenced under the term Ice Age of Anatomy and Obstetrics, highlight the early origins of this method. In March 1870, anatomist Wilhelm Braune, at his Leipzig institute, received the body of a young woman who had hanged herself in the final month of pregnancy. Rather than performing a conventional dissection, Braune employed an unconventional approach: he froze the cadaver and then sliced it vertically to produce what is considered the first 'frozen sections' of a pregnant body [4]. The frozen section technique was initially introduced by William H. Welch at Johns Hopkins Hospital in 1891 for intraoperative consultation. The method was subsequently refined by Wilson and McCarty in 1905 at the Mayo Clinic [5]. Contemporary research offers relatively limited discussion regarding the use of this technique within obstetrics. Most of the scientific literature has concentrated on ovarian neoplasms in the context of gynecologic oncology. Preoperative clinical assessment, imaging studies, and serum CA125 levels do not provide a definitive diagnosis for ovarian tumors. In this context, intraoperative consultation through frozen section analysis is essential for guiding appropriate surgical management of ovarian neoplasms. Surgical management of ovarian tumors is guided by the tumor's histopathological characteristics. Benign lesions are generally managed conservatively through cystectomy or oophorectomy. Borderline tumors typically necessitate pelvic lymph node assessment along with limited omental sampling; however, procedures that preserve fertility and ovarian function remain the preferred approach in young women. For malignant tumors, comprehensive staging and cytoreductive surgery are indicated, which may include total abdominal hysterectomy with bilateral salpingo-oophorectomy, lymph node sampling, peritoneal biopsies, and omentectomy [6].

Another retrospective study, conducted in accordance with the Declaration of Helsinki, received approval from the Institutional Review Board of the National Cancer Center, Tokyo, Japan (2021). The study reviewed data from 875 patients with ovarian tumors who underwent intraoperative frozen section evaluation between January 1997 and January 2019. The findings indicated an overall concordance rate of 93.8% for frozen section diagnoses, with diagnostic sensitivities of 99.6% for benign and 93.2% for malignant ovarian tumors. In contrast, for borderline tumors, the sensitivity and positive predictive value of frozen section diagnosis were 85.6% and 79%, respectively [7]. Kung et al. noted that, although a survey conducted in the United Kingdom indicated that intraoperative frozen section is performed less frequently, this approach remains standard practice in many other countries. In their 11-year review of frozen section analysis of ovarian tumors,

the authors concluded that effective intraoperative communication between surgeons and pathologists is essential to ensure accurate information exchange and to minimize the risk of diagnostic errors [8].

In the presented report, we consider a clinical case that appeared as a serous cystadenoma on ultrasound, which turned out to be a dermoid cyst only during cesarean section and resulted in adnexectomy. In our clinical experience, intraoperative frozen section analysis was utilized, and the diagnosis of a mature ovarian teratoma was subsequently confirmed by final histopathological examination.

■ CASE REPORT

A 19-year-old primigravida (G1 P0) woman presented to the Obstetrics and Gynecology Department for prenatal care, starting from the 9th week of pregnancy. A routine antepartum ultrasonographic examination revealed a 9-week uterine pregnancy with a live fetus consistent with gestational age, exhibiting a positive heart rate of 170 beats per minute. Additionally, a septate anechoic tumor was found in the left adnexa, which was suspected to be a large serous cystadenoma. Despite the experienced specialist performing the ultrasound examination, it has been suggested that magnetic resonance imaging could help the patient and after the 16th week of pregnancy, information has been provided about the possibility of laparoscopic surgery. However, the patient has chosen to decline both the recommended additional radiological examination and surgical intervention, indicating her readiness to grant consent only in the case of an emergency. A transabdominal ultrasound revealed that the size of the cyst during the pregnancy was

16.17×10.16 cm at 12 weeks 14.42×9.71 cm at 19 weeks, 15.15×9.81 cm at 28 weeks, and 13.75×9.41 cm at 32 weeks, 14.09×9.68 cm at 37 weeks (Fig. 1). In dynamic ultrasonographic images, no acoustic shadows, no solid components within the tumor, or no ascites in the abdominal cavity have been observed in the pathological adnexal region. The opposite ovary has been visualized as normal in size and structure. However, since the tumor showed no increase in size and was asymptomatic, no surgical intervention was deemed necessary. In the 37th week of pregnancy, the patient presented to the clinic with labor pains. The patient opted against vaginal delivery. Consequently, during the cesarean section, excision of the cyst guided by intraoperative frozen section analysis was planned. Intraoperative examination of the abdominal cavity revealed a large cystic mass in the left adnexal region, while the uterus was consistent with the expected gestational age. The cyst measured approximately 14×10 cm, exhibited a reddish coloration, and was enclosed by a thick, rounded capsule. Healthy ovarian tissue was not identifiable, and the left fallopian tube was also involved in the pathological process. The right adnexa appeared unremarkable. A Caesarean section was successfully performed, and a live baby boy weighing 3380 g and measuring 49 cm in length was delivered. The newborn's Apgar scores were 7 points at 1 minute and 8 points at 5 minutes, indicating a healthy condition. The integrity of the uterus was restored.

During the operation, the cyst fluid was punctured, while the cyst was still inside the peritoneal cavity (Fig. 2). The cyst fluid was yellowish color. After obtaining histological material for the frozen section, mild fibrous tissue and delicate fibrous strands were discovered within the cyst cavity. Teeth, nails, and other tissue forms were not observed. The cyst fluid was sent for urgent histological examination, which ruled out malignancy

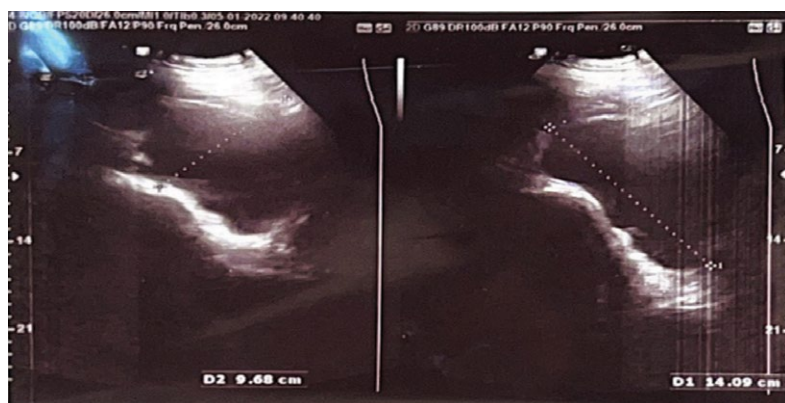


Fig. 1. Ultrasound image of the left ovarian cyst before Caesarean section



Fig. 2. Puncture of cyst contents for frozen section examination

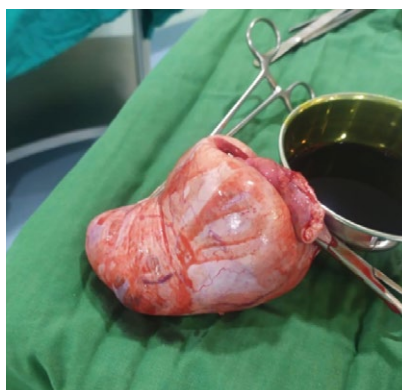


Fig. 3. Macropreparation (left ovarian cyst) removed during surgery (syst fluid was removed)

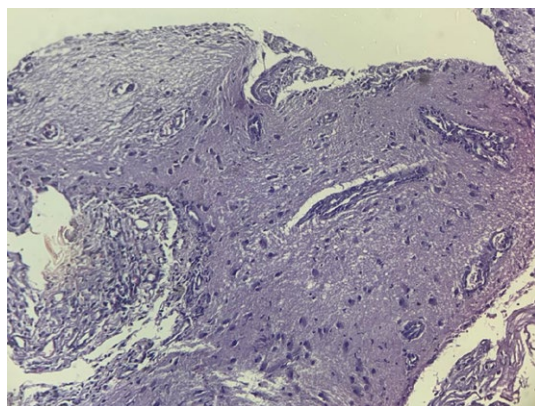


Fig. 4. ×400 magnification. There are glial cells, embedded in fibrillary stroma (Paraffin embedded hematoxylen-eosin staining Microscope Leica DM1000 – Germany)

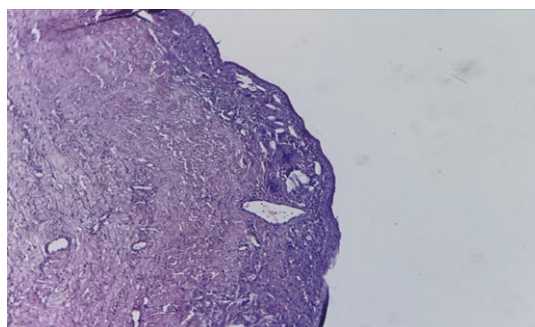


Fig. 5. ×200 magnification. Cyst wall, covered by epidermis, there is foreign body reaction under epithelium (multinucleated giant epithelioid histiocyte can be seen) (Paraffin embedded hematoxylen-eosin staining Microscope Leica DM1000 – Germany)

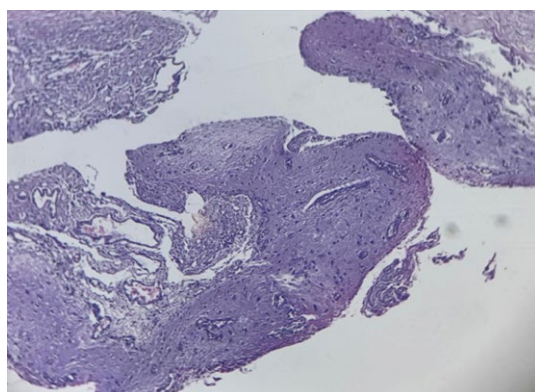


Fig. 6. ×100 magnification. Neuronal tissue in the cyst wall (Paraffin embedded hematoxylen-eosin staining Microscope Leica DM1000 – Germany)

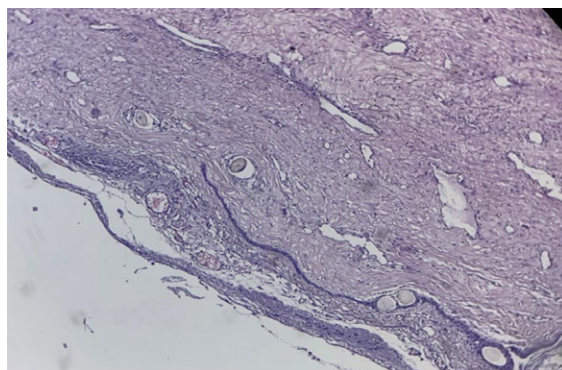


Fig. 7. ×200 magnification. Cyst wall, covered by epidermis. There are skin appendages under epidermis (hair follicles) (Paraffin embedded hematoxylen-eosin staining Microscope Leica DM1000 – Germany)

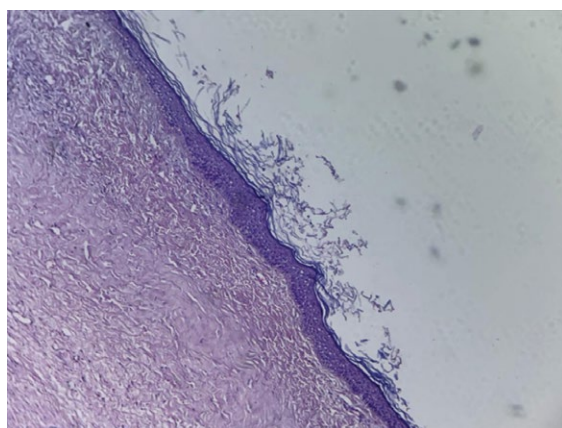


Fig. 8. ×200 magnification. Cyst wall, covered by epidermis with hyperkeratosis and anuclear keratinocytes (Paraffin embedded hematoxylen-eosin staining Microscope Leica DM1000 – Germany)

based on frozen section results. Considering the absence of healthy ovarian tissue and the involvement of the left fallopian tube in the pathological process, the patient provided consent for a left-sided adnexectomy, which was subsequently performed. The weight of the adnexal mass after removal of fluid was about 400 grams. The removed tumor was further analyzed through detailed histological examination (Fig. 3). The histological results confirmed a diagnosis of benign mature teratoma (Fig. 4–8).

The patient had smooth surgery, and the postoperative period was uneventful.

■ DISCUSSION

Mature teratoma refers to the most frequent ovarian tumors during pregnancy and is characterized by a slow growth rate of 1.8 mm per year in most cases [9]. Mostly, the diagnosis is made during routine ultrasound examinations. The share of this examination in the correct diagnosis of dermoid cysts is high. However, sometimes, as in the case

presented by us, ultrasound indicators may not always be accurate. From the reviewed scientific literature, it is evident that ovarian dermoid cysts often go undetected on ultrasound during the early stages of pregnancy, yet they tend to grow rapidly in the second half of gestation. A case report from the Departments of Obstetrics and Gynecology and Radiology at Antoine Beclere Hospital in France particularly drew our attention. The article reports that a large ovarian cyst was identified at 22 weeks of gestation in a 32-year-old woman, despite no adnexal mass being detected on ultrasound at 12 weeks. Due to rapid enlargement and a total size exceeding 20 cm, a right adnexectomy was performed via laparotomy at 28 weeks. Histopathological analysis confirmed the diagnosis of an ovarian cystic teratoma. The authors note that dermoid cysts are typically slow growing, even in premenopausal women, which may be related to an atypical pattern of estrogen and progesterone receptor expression within the cystic teratoma [10]. In some sources, this occurrence is described as the 'invisible tumor phenomenon'. Similarly, a case report documented the incidental discovery of a mature teratoma in the right ovary during a cesarean section. This finding was unexpected, as serial ultrasounds from the 8th to 9th week of gestation had not revealed any significant ovarian abnormalities. Postoperative histological examination subsequently confirmed the diagnosis of a mature teratoma in the right ovary [11]. Recent scientific reports (2021) have also emphasized that a proportion of adnexal masses continue to be detected unexpectedly during cesarean deliveries [12]. Only a small number of published cases have described a possible association between the size of an ovarian cyst and the occurrence of IUGR [13]. We consider that the difficulties in identifying ovarian teratomas on ultrasound during pregnancy may stem from pregnancy-related shifts in the anatomical and topographical arrangement of the female reproductive organs, as well as changes in tissue characteristics, including those of the tumor. In such situations, magnetic resonance imaging (MRI), and in more complicated cases, computed tomography (CT), can aid in achieving a more accurate diagnosis.

In another noteworthy case report, a 37-year-old pregnant woman at six months' gestation presented with abdominal pain. The initial management plan was based on a presumed diagnosis of fecaloma. As her condition deteriorated, clinicians suspected an intestinal pathology following an MRI examination. A subsequent CT scan – performed when indicated – revealed a dermoid cyst in the left ovary. The authors concluded that ovarian teratomas may exhibit unusual clinical and imaging features, and that pregnancy can limit the effectiveness of ultrasound in clearly defining these lesions. Therefore, tomographic imaging methods may be necessary in selected cases [14].

It's noteworthy that in our case, an MRI examination was suggested to the patient for further clarification of the nature of the ovarian tumor, but the patient declined this option. As for pregnant patients with mature teratoma, according to the results of the study conducted by Kaspi B. and all on 49 such pregnant women, since dermoid cysts smaller than 6 cm do not grow during pregnancy and no complications are observed in such patients, the choice of conservative observation is supported [15]. Tumors larger than 10 cm should be considered for resection because of the risk of torsion, tearing, and high malignancy. The approach to 5–10 cm cysts remains controversial. One group of researchers recommends resection of a cyst of this size if the structure is complex (septation, node, etc.), while others recommend keeping it under control if it is a simple cystic structure [16]. According to the research of Schmeler KM and all, the selection of surveillance tactics in the management of adnexal masses with a low probability of malignancy based

on the results of ultrasonographic images is more appropriate [17]. According to the research of Hess LW and all, pregnant women whose surgery was delayed until the onset of symptoms and therefore underwent emergency surgery for the removal of adnexal tumor were more likely to have a poor prognosis of pregnancy outcomes than those who underwent elective surgery [18]. According to Muhammad Osto, laparoscopic intervention should be considered for early prevention of complications of ovarian tumors larger than 5 cm [19]. In the scientific sources investigated by us, we did not find any information on frozen examination of cystomas during caesarean section due to large-sized ovarian cysts during pregnancy. However, in case of the malignancy of cystomas (including mature teratomas), there is a need to expand the scope of the surgical operation in terms of radicality. We found additional evidence in the literature emphasizing the role of frozen section during gynecologic surgical procedures. Sukumaran et al. (2014) argue that imaging alone has notable limitations in accurately characterizing ovarian masses, particularly when the lesions are large. Since preoperative diagnostic methods often provide insufficient information regarding the true nature of ovarian tumors, intraoperative frozen section becomes essential by offering a rapid histologic assessment, thereby enabling the surgeon to choose the most appropriate surgical strategy. However, several authors point out that frozen section also has certain constraints, especially when dealing with borderline tumors [20]. This viewpoint aligns with the findings reported by Hashmi et al., who identified that frozen section demonstrates high sensitivity and specificity in diagnosing ovarian tumors and in assessing their malignant potential. The authors suggest that it should therefore be employed whenever the preoperative diagnosis is uncertain, as it helps guide the appropriate extent of surgical removal. Nonetheless, under-diagnosis may still occur in borderline tumors – particularly those with mucinous histology – though this limitation can be reduced by obtaining a greater number of samples during frozen section analysis [21].

Among the scientific publications of recent years highlighting the significance of frozen section, the retrospective population-based study by Asp. et al. (2022) involving patients who underwent surgery for suspected ovarian cancer drew particular attention. The authors report that out of 358 individuals diagnosed with ovarian cancer, frozen section evaluation was performed in 187 cases, whereas the rest proceeded to surgery without it. Consequently, 22 patients who had surgery without frozen section required a second operation, including 5 who had been mistakenly classified as having ovarian cancer. Notably, such misclassifications did not occur in the group where frozen section had been utilized [22]. In a separate investigation by Palakkan et al. (2020), the authors assessed the sensitivity and specificity of frozen section for diagnosing ovarian tumors by comparing intraoperative findings with the final histological results. The overall concordance of frozen section with the definitive histopathologic diagnosis was reported to be 93.3%. The technique demonstrated high sensitivity, specificity, and strong positive and negative predictive values for both benign and malignant ovarian neoplasms. Frozen section proved to be a reliable and valuable tool for intraoperative assessment of ovarian tumors, offering guidance in determining the appropriate type and extent of surgical intervention [23]. In research carried out by Ratnavelu et al. in 2016 and published in the Cochrane Database of Systematic Reviews, the role of frozen section analysis in the intraoperative evaluation of ovarian masses suspected to be malignant was assessed. The findings demonstrated that when frozen section suggested a benign lesion or an invasive

malignancy, the final histopathological diagnosis matched roughly 94% and 99% of cases, respectively. In contrast, when the frozen section result indicated a borderline tumor, about 21% of these were ultimately confirmed as invasive cancer on final evaluation [24].

According to Kennedy NT et al. (2019), frozen section evaluation for ovarian tumors is frequently requested to determine the most appropriate surgical approach. It is particularly important for use in younger women before any procedure that might compromise fertility, and in older patients prior to undertaking extensive or high-risk surgery. The proactive measures proposed may help enhance the overall diagnostic precision of frozen section analysis. Close collaboration between surgeons and pathologists is essential at every center to ensure that frozen section provides the greatest possible benefit when assessing complex ovarian masses [25]. However, in an article derived from the Children's Oncology Group (COG) study AGCT0132, Dicken et al. point out that the histologic profile of ovarian tumors in children and adolescents differs significantly from that seen in adults. In younger patients, germ cell tumors constitute a larger proportion overall, and the rate of malignancy within this category is notably higher. Surface epithelial neoplasms are uncommon in the pediatric population. This rarity is partly explained by the fact that, in malignant ovarian germ cell tumors of children and adolescents, the use of frozen section is largely confined to intraoperative assessment only [26].

Research from scientific sources has shown that the discovery of a significantly mature teratoma during a cesarean section, along with studies and cases on the application of frozen section in obstetrics, is relatively limited. We believe that the case report we have presented reaffirms the importance of analyzing frozen sections during a cesarean section in women with large-sized mature ovarian tumors, underscoring its theoretical and practical significance for healthcare professionals. In clinical practice, there may be cases where healthy ovarian tissue is not found in mature teratomas, as in our case. In our opinion, performing intraoperative frozen sections in women with large ovarian tumors, especially in young patients, is not only important for ensuring the correct surgical procedure but also crucial in preserving fertility. At this time, the frozen examination of the pathological tissue provides oncological caution in the diagnosis of ovarian cysts and determines the radical approach to the treatment of the disease. If the whole ovary is involved in the pathological process, in order to prevent the formation of recurrent dermoid cysts and the prevention of neoplastic processes, oophorectomy should be preferred (as in our case), regardless of the age of the patient, rather than partial resection. However, in the case of choosing this tactic, each patient should be treated individually, the possible complications, indications for surgery should be carefully considered.

■ CONCLUSIONS

Our research has shown that despite the extensive use of frozen section in oncogynecology, its application is limited in obstetrics. The presented case highlights the possibility of discovering an ultrasoundly undiagnosed ovarian mature teratoma during a cesarean section, demonstrating the potential for conducting frozen sections and determining the extent of the surgical procedure. The manuscript emphasizes the insufficient informativeness of ultrasonography in the diagnosis of teratomas in obstetrics, as well as the necessity for multidisciplinary collaboration between intraoperative surgeons and pathologists.



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