Clinical outcomes of fetal ovarian masses diagnosed by prenatal ultrasonography and literature review

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Abstract

With the advancement of prenatal examination technology, more and more fetus with ovarian masses are diagnosed. However, whether such children need intervention measures after delivery, there is no more unified diagnosis and treatment measures in the world. In this study, postnatal data and clinical outcome of fetal diagnosed with ovarian masses were analyzed. We also combined with relevant literature to explore the postpartum intervention measures and timing of such children. A total of 57 cases of abdominal masses from the reproductive system were included in the study. These children were diagnosed with ovarian masses after birth. We collected from 2012 to 2020, the prenatal examination revealed the presence of abdominal masses from the reproductive system, and diagnosis was confirmed by imaging examinations after childbirth. We counted the fetal period data of these children, compared the changes in the postnatal pathology and intervention measures. A total of 57 cases of ovarian masses were diagnosed prenatally, 1 case was lost to follow-up, and 56 cases were finally included in the study. After birth a total of 21 cases of ovarian masses were treated conservatively, of which 18 cases resolved spontaneously during the follow-up process, with an average follow-up period of 30.88 ± 18.16 weeks. There were statistically significant differences in the nature and the maximum diameter of the mass between the two groups receiving conservative treatment or surgical treatment after delivery (P < .05). Univariate and multivariate Logistic regression analysis showed that there were significant differences in the nature and diameter of the mass between two groups (P < .05). In addition, we divided the children undergoing postpartum surgery into a laparoscopic surgery group and a conventional open surgery group. Through data analysis, we found that there were statistically significant differences in the age of operation, operation time, and hospitalization days in the two groups of these children (P < .05). Children diagnosed with ovarian masses prenatally generally have a good prognosis. For these children, the treatment plan should be developed according to the child general condition. If child with ovarian mass is treated with surgery, the preservation of ovarian tissue should be emphasized regardless of the size, nature, and torsion of the mass.

Abbreviation: AUC = area under the curve.

Keywords: ovarian masses; prenatal ultrasonography; fetus; surgery; prognosis

Introduction

Ovary is the most common source of intra-abdominal masses in female fetuses. Ovarian masses mostly originate from ovarian epithelial tissues, most of which are benign and multiple on one side. Simple ovarian masses usually have a certain degree of self-limitation, and can resolve spontaneously within a few months after delivery. However, ovarian torsion and even ovarian necrosis may also occur.

With the development of prenatal examination technology, more and more ovarian masses can be diagnosed early. However, there is no more uniform diagnosis and treatment measures in the world as to whether such children need intervention measures after childbirth and how to grasp the timing.

In this study, we collected relevant data of children with ovarian masses diagnosed prenatally, and summarized their fetal period, postnatal data and clinical related data. We also combined with literature to provide a basis for the clinical post-partum treatment of such prenatal diagnosis of ovarian masses in these children.

Materials and Methods

1.1 Selection of research objects

In this study, we selected children whose prenatal examinations revealed the presence of abdominal masses (reproductive system origin) from January 2012 to June 2020. They were diagnosed by...
imaging examinations after delivery and underwent surgical treatment or outpatient follow-up at the Children’s Hospital of Soochow University. (This study has been approved by the Ethics Committee of the Children’s Hospital of Soochow University: 2021CS053)

1.2 Inclusion and exclusion criteria

Inclusion criteria: Prenatal ultrasound examination revealed an intra-abdominal mass (reproductive system origin), and related cases were diagnosed after childbirth in the Children’s Hospital of Soochow University.

Exclusion criteria: Incomplete clinical data, related cases lost to follow-up due to various reasons.

1.3 Statistical methods

Statistical analysis was performed with SPSS25.0 software. The measurement data conforms to the normal distribution are expressed by the mean ± standard deviation (x ± s). The measurement data that does not conform to the normal distribution are described by the median and interquartile range. The independent-sample T test was used to compare the two groups when the variance was homogeneous, and the non-parametric test was used if the variance was not uniform and did not meet the conditions of the analysis of variance after correction. For count data, use the chi-square test when n ≥ 40 and T ≥ 1, use the conditions of the analysis of variance after correction. For test was used if the variance was not uniform and did not meet when the variance was homogeneous, and the non-parametric independent-sample T test was used to compare the two groups.

1.4 Definition of relevant research variables

In this study, the pregnancy cycle is divided into two parts, 21 to 28 weeks of gestation is the second trimester, and after 28 weeks of gestation is the second trimester. And through reading the literature, the different manifestations of the nature of ovarian masses in ultrasound examination are divided into 2 types: simplicity and complexity. The simple ultrasound diagnosis criteria are: good sound penetration inside the lesion, thin and smooth wall; the complex ultrasound diagnostic criteria are: poor sound penetration inside the lesion, visible dense punctate echo or floculent echo, or visible separation.

Results

In this study, 57 cases of ovarian masses were diagnosed prenatally, 1 case was lost to follow-up, and a total of 56 cases were finally included. Among them, 42 cases were considered as ovarian cysts, 14 cases were ovarian teratomas, 8 cases were diagnosed in the second trimester (21–28 wk of gestation), and the remaining 48 cases were diagnosed in the second trimester (after 28 wk of gestation). A total of 21 cases were treated conservatively and 35 cases underwent surgical treatment. 19 cases occurred in the left ovary, 37 cases occurred in the right ovary, and no cases occurred in both ovaries before surgery. In this study, children were divided into conservative treatment group and surgical treatment group. Through data analysis (Table 1), it was found that the differences in the nature of the mass and the maximum diameter of the mass between the two groups were statistically significant (P < .05). There was no statistical significance in other factors, such as: the age of the mother, the number of mothers' pregnancy and childbirth, mother's production method and child's birth weight (P > .05).

There were 21 children underwent conservative treatment, of which 3 cases were still in the follow-up process, and the other 18 cases disappeared spontaneously during the follow-up process, accounting for about 85.7% of the total follow-up number (Fig. 1). However, 3 cases had enlarged mass during the postpartum follow-up. The longest follow-up time for the mass disappeared was 68 weeks, and the average follow-up period was 30.88 ± 18.16 weeks.

Total 35 children underwent surgical treatment, 21 underwent laparoscopic surgery, 14 underwent conventional open surgery, and one child had multiple small cysts on the contralateral ovary during laparoscopic surgery. The contralateral ovaries were found to be normal in the other children during the operation. All children were reviewed regularly in outpatient clinics after the

Table 1

Prenatal diagnosis of ovarian masses and the basic situation of conservative treatment or surgical treatment after delivery.

|                      | Conservative treatment (n = 21) | Surgical treatment (n = 35) | P       | Z/ χ²/T |
|----------------------|-------------------------------|-----------------------------|---------|---------|
| Gestational age      |                               |                             |         |         |
|                      | First pregnancy                | 13                          | 15      | .168    | 1.905  |
|                      | Multiple pregnancies           | 8                           | 20      |         |       |
|                      | Normal delivery                | 11                          | 23      | .323    | 0.978  |
|                      | Cesarean section               | 10                          | 12      |         |       |
|                      | Birth weight (kg)              | 3.28 ± 0.39                 | 3.29 ± 0.49 | .935  | -0.082 |
|                      | The clinical manifestation     | Yes                         | 7       | .237    | 1.400  |
|                      |                               | No                          | 20      |         |       |

Entries in bold are emphasized P < 0.05.
operation, and there were no obvious abnormalities in the follow-up of 33 children. One child was diagnosed with a right ovarian teratoma during the operation and underwent laparoscopic right ovarian teratoma resection. During the follow-up, a left ovarian cyst appeared and the cyst disappeared after conservative treatment. Another child was diagnosed with a right ovarian cyst during the operation, so we removed the right ovarian cyst. Later, during the follow-up process, the child had a right ovarian cyst again, and the cyst disappeared spontaneously after conservative treatment. We performed univariate Logistic regression Analysis to diagnose ovarian masses before delivery and whether surgery should be performed after delivery. Through reading the literature, we divided the largest diameter of the mass in the collected cases into binary variables of <5 cm and ≥5 cm, and included the mass diameter grouping. And through data analysis (Table 2), we found that there were statistically significant differences in the nature and diameter of the mass between the two groups (P < .05), while there were no statistically significant differences in other factors, such as mother’s age, mother’s number of pregnancy and childbirth, mother’s production method, child’s birth weight and whether there were clinical manifestations (P > .05).

The univariate Logistic regression analysis results of factors that are meaningful for surgery were included in the multivariate Logistic regression analysis (Table 2). After gradually screening the meaningful independent variables, it is concluded that the nature (P = .018, odds ratio = 8.024) and the diameter (P < .001, OR = 44.954) of the mass may be prenatal diagnosis of the ovarian mass is a predictive factor for postpartum surgery. In order to further verify the ability of two factors to predict whether the child needs surgery after delivery, the receiver operating characteristic curve was drawn (Fig. 2). The area under the curve (AUC) of the mass nature is 0.662; the AUC of the mass diameter is 0.824, and the combined AUC of the two is 0.893.

We divide children undergoing surgical treatment into laparoscopic surgery group and conventional open surgery group through different surgical methods. Through data analysis (Table 3), we found that there were statistically significant differences in operation age, operation time and hospitalization days between the two groups (P < .05). There was no statistical significance in other factors, such as whether contralateral ovarian abnormalities, whether alpha-fetoprotein and carcinoembryonic antigen were increased before the operation (P > .05).

Discussion

At present, the etiology of the ovarian mass is still unclear. Some scholars believe that if the mother suffers from diabetes, eclampsia and other diseases during pregnancy, or the mother has multiple pregnancy, it will enlarge the placenta and cause the placenta to produce higher than the constant human chorionic gonadotropin, which will lead to the occurrence of ovarian cysts. However, in this study, it was not found that the occurrence of ovarian mass was related to abnormalities during pregnancy or multiple pregnancy. Usually, after delivery because of the reduction of maternal hormone stimulation, the mass will shrink or even disappear. However, there are a small number of children with severe complications such as intestinal obstruction, and ovarian torsion resulting in necrosis after birth.

![Figure 1. 18 cases of prenatal diagnosis of ovarian masses and the relationship between the size and time of the disappearance of the mass during the postpartum follow-up diagnosis.](image)

| Table 2 |
| Summary of factors included in the logistic regression analysis. |
| --- | --- | --- |
| | Univariate regression | Multivariate analysis |
| | OR | 95%CI | P | OR | 95%CI | P |
| Nature of the mass | 3.833 | 1.220–12.042 | .021 | 8.024 | 1.434–44.885 | .018 |
| The diameter of the mass | 27.444 | 5.311–141.821 | <.001 | 44.954 | 6.442–313.684 | <.001 |
| Gestational age | 3.333 | 0.706–15.737 | .128 |
| Mother’s age (yr) | 0.941 | 0.821–1.078 | .382 |
| The frequency of pregnancy and childbirth | 2.167 | 0.717–6.550 | .171 |
| The production method | 0.574 | 0.190–1.732 | .325 |
| Birth weight (kg) | 1.052 | 0.320–3.465 | .933 |
| The clinical manifestation | 0.200 | 0.023–1.756 | .146 |

Entries in bold are emphasized P < 0.05; OR = odds ratio.
The timing of intervention for ovarian mass is different in different periods. In the early stage, most scholars believe that once ovarian masses are found, in order to avoid complications, surgical treatment should be actively performed. However, when the parents requested and the child had no obvious clinical manifestations, the ultrasound was reviewed regularly in the outpatient clinic. In the end, the mass of the two children could resolve spontaneously. In addition, we also found that the postpartum imaging examination results of 3 children showed that the ovarian mass was enlarged to varying degrees compared with the prenatal imaging examination results. We think this may be related to the regulation of hormone levels in the body after delivery, but further clinical data and experimental verification are still needed. However, the mass’s size of these 3 children decreased to varying degrees during the subsequent follow-up, and eventually the mass disappeared spontaneously. However, in the surgical treatment group, only 4 children with prenatal and postpartum reexamination showed that the maximum diameter of the ovarian mass was ≥40 mm. In this study, the mass diameter is one of the factors predicting whether to undergo surgery after delivery. Therefore, we believe that children can be divided into different ovarian mass diameters: Children with the largest ovarian mass diameter <40 mm can be treated conservatively. Regular outpatient review imaging examinations are possible, and most of them can resolve spontaneously without surgical intervention; For children with the largest diameter of the ovarian mass ≥40 mm and the postpartum reexamination imaging examination, the mass’s size is larger than before can be also temporarily treated conservatively if there is no clinical manifestation. However, the follow-up period should be shorter than that of the first type of children; Once the mass’s size continues to increase during the follow-up process, even the largest diameter of the mass is ≥50 mm or the child has clinical manifestations, surgical treatment should be performed as soon as possible.

If the ovarian mass is diagnosed prenatally, it is considered as an ovarian cyst in the postpartum review imaging examination. Usually, the nature of the cyst can be divided into simplicity and complexity. At present, it is generally believed that simple cysts can be temporarily treated conservatively, but the treatment of complex cysts is still controversial. Scholars such as Luzzatto C mentioned in the literature of 27 children with prenatal diagnosis of ovarian cysts that both simple and complex cysts have a tendency to resolve spontaneously after birth. They also carried out statistics and analysis on the spontaneous regression time of different types of cysts. They found that the time required for complete disappearance of complex cysts (average 8 mo) was longer than simple cysts (average 3.5 mo). In our study, it was found that the time for simple cysts to resolve spontaneously was 25.60 ± 15.10 weeks, and the time for complex cysts to resolve spontaneously was 30.66 ± 17.92 weeks. There was no significant difference between them (P > .05). Although there are no cases of ovarian malignant tumors in our study, we still recommend that for ovarian masses diagnosed prenatally, regular blood tests such as tumor markers should be taken during the conservative treatment process after delivery, especially if it is considered Children with ovarian cysts and the nature of the cysts are complex. In this study, the nature of the mass is one of the factors predicting whether to undergo surgery after delivery. Some scholars believe that complex cysts represent ovarian torsion before delivery, so the possibility of successful ovarian salvage is very low. In our study, a total of 23 cases of simple cysts were considered prenatally, and 11 cases underwent surgical treatment, of which only 4 cases underwent ovariectomy. Postoperative pathology showed as Giorlandino C believe that once the mass diameter is greater than 50mm, surgery should be recommended. In this study, 19 children in the conservative treatment group had the largest diameter of the ovarian mass <40 mm before and after delivery, and the imaging examination showed that the largest diameter of the ovarian mass was >40 mm. In another case, the prenatal and postnatal reexamination imaging examinations showed that the maximum diameter of the ovarian mass was >50 mm. However, when the parents requested and the child had no obvious clinical manifestations, the ultrasound was reviewed regularly in the outpatient clinic. In the end, the mass of the two children could resolve spontaneously. In addition, we also found that the postpartum imaging examination results of 3 children showed that the ovarian mass was enlarged to varying degrees compared with the prenatal imaging examination results. We think this may be related to the regulation of hormone levels in the body after delivery, but further clinical data and experimental verification are still needed. However, the mass’s size of these 3 children decreased to varying degrees during the subsequent follow-up, and eventually the mass disappeared spontaneously. However, in the surgical treatment group, only 4 children with prenatal and postpartum reexamination showed that the maximum diameter of the ovarian mass was ≥40 mm. In this study, the mass diameter is one of the factors predicting whether to undergo surgery after delivery. Therefore, we believe that children can be divided into different ovarian mass diameters: Children with the largest ovarian mass diameter <40 mm can be treated conservatively. Regular outpatient review imaging examinations are possible, and most of them can resolve spontaneously without surgical intervention; For children with the largest diameter of the ovarian mass ≥40 mm and the postpartum reexamination imaging examination, the mass’s size is larger than before can be also temporarily treated conservatively if there is no clinical manifestation. However, the follow-up period should be shorter than that of the first type of children; Once the mass’s size continues to increase during the follow-up process, even the largest diameter of the mass is ≥50 mm or the child has clinical manifestations, surgical treatment should be performed as soon as possible.

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![Figure 2. ROC curves for the prediction model of prenatal diagnosis of ovarian mass and postpartum surgical treatment. ROC = receiver operating characteristic curve.](image)

| Table 3 | Basic situation of different surgical methods. |
|---------|------------------------------------------------|
|         | Laparoscopic surgery (n = 21) | Conventional open surgery (n = 14) | P | Z/2|T |
|Age (wk) | 13.00 (4.00, 18.00) | 3.50 (1.00, 8.50) | .025 | -.247 |
|Operation time (mins) | 51.67 ± 17.98 | 73.21 ± 21.80 | .003 | -.3.190 |
|Hospitalization days (d) | 8.05 ± 2.39 | 12.50 ± 6.02 | .018 | -.632 |
|Contralateral ovarian abnormality | Yes | 1 | 0 | <.999 |
| | No | 20 | 14 |
|Merge other deformities | Yes | 6 | 0 | .061 |
| | No | 15 | 14 |
|Alpha-fetoprotein (AFP) | High | 8 | 3 | .461 |
| | Normal | 13 | 11 |
|Carcinoembryonic antigen (CEA) | High | 2 | 1 | <.999 |
| | Normal | 19 | 13 |
|Review situation | Abnormal | 1 | 1 | <.999 |
| | Normal | 20 | 13 |

Entries in bold are emphasized P < 0.05.
simple cysts, while a total of 19 complicated cysts were considered prenatally. Of the 13 cases, surgical treatment was performed, of which 4 cases retained ovarian tissue and only underwent cystectomy or fenestration. However, in this study, prenatal ultrasonography in one child showed a simple cyst. During the follow-up, the cyst became complicated, combined with comprehensive clinical manifestations, the child were treated surgery. The child was diagnosed with ovarian torsion during the operation. When prenatal diagnosis of ovarian masses, postpartum review imaging examinations consider ovarian-derived tumors, such as ovarian teratomas, in order to avoid complications such as ovarian torsion and malignant transformation, surgical treatment should be recommended. In this study, a total of 14 cases showed ovarian teratomas after postpartum reexamination and imaging examinations. 11 cases underwent surgical treatment, all underwent ovariectomy, and the postoperative pathology was mature teratoma. Due to the short follow-up time and the temporary conservative treatment at the request of family members, the children are currently undergoing regular outpatient follow-up. Therefore, we believe that prenatal diagnosis of ovarian masses, according to the nature of the mass children are divided into: Simple cyst is suggested before childbirth, conservative treatment is feasible after childbirth, and regular outpatient follow-up. If the nature of the mass changes during the follow-up or the child has clinical manifestations, surgical intervention is required as soon as possible; Complicated cysts are suggested before delivery. Surgical intervention should be combined with the size of the cyst and whether there are clinical manifestations after delivery. If conservative treatment is temporarily considered after comprehensive consideration, the follow-up period should be shorter than that of simple cysts. We believe that such children should be checked for tumor markers on a regular basis, and if clinical manifestations occur, they need to be treated immediately; Postoperative imaging examination suggests that there is substantial part of the ovarian mass or calcification, and ovarian tumor cannot be excluded. Therefore, surgical treatment is recommended.

The timing of intervention for ovarian mass is usually divided into prenatal intervention and postnatal intervention. Scholars believe that the abdominal cavity volume of children of different age groups have more cases of conventional open surgery. It is generally believed that the abdominal cavity volume of children of the younger age group is more suitable for laparoscopic surgery. In 1995, Van der Zee DC and other scholars published in 2021 that laparoscopic surgery is increasingly accepted and is worthy of promotion. In the current situation of the mass with the ovary and its impact on the development and reproductive health of the fetus still exists, and the probability of recurrence is higher. Literature also supports this view. The literature points out that if the mass is considered for masses, the age of the child at the time of surgery is not an important factor in determining the method of surgery. Scholars also pointed out in the literature that laparoscopic treatment of neonatal ovarian cysts is a safe and effective surgical method. Therefore, we believe that the surgical method should be determined based on the general condition and other relevant conditions of the child at that time.

The complex regulation and uncertainty of various hormones caused by the future growth and development of children. At present, most scholars believe that ovarian tissue should be preserved as much as possible during surgery to reduce the impact of surgery on the future daily life, growth and development of children. Of the 35 children in this study who underwent surgical treatment, 24 underwent ovariectomy on the affected side during the operation. In the follow-up process, the contralateral ovarian cyst was found in 1 case, which resolved spontaneously, and the contralateral ovaries had no obvious abnormalities in the other cases. However, there is still a lack of long-term follow-up information literature, for the long-term hormone levels, survival, and recurrence statistics of children who consider ovarian torsion during surgery and only undergo reduction of diseased ovarian torsion. The probability of contralateral ovary torsion and its impact on the development and reproductive health of the child. This is also our future research direction.

Conclusion

1. Children with ovarian masses diagnosed before childbirth generally have a good prognosis.
2. Postpartum ovarian masses need to undergo imaging examination to further confirm the diagnosis. The next treatment plan should be determined according to the size and nature of the mass.

Author contributions

Data curation: Ruze Tang
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Methodology: Shungen Huang
Supervision: Zhicheng Gu, Shungen Huang, Jian Wang
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Disclaimer

The authors confirm that there are no conflicts of interest.
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