



Adnexal masses during pregnancy

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Abstract

Aim: Routine ultrasound scanning for fetal anomaly detection has enabled increased recognition of adnexal masses during pregnancy in recent years. In addition to incidental detection during routine antenatal follow-up, adnexal masses may also be identified in pregnant women presenting with an acute abdomen. In this study, we aimed to evaluate the clinicopathological features of lesions detected in pregnant women presenting with acute abdomen and in those with incidentally detected adnexal masses during routine antenatal clinical and radiological examinations.

Methods: Pregnant women evaluated between 2013 and 2020 who presented with acute abdomen or had incidentally detected adnexal masses during routine clinical and radiological examinations were retrospectively identified from the clinical databases of the Departments of General Surgery and Obstetrics and Gynecology. Patients with ectopic pregnancy were excluded.

Results: We included 44 pregnant women with a median age of 28.5 years (range, 18–42 years). Ten patients presented during the first trimester, 24 during the second trimester, and 10 during the third trimester. Most patients did not require surgery. Among surgically treated patients, benign lesions predominated, with mature cystic teratoma being the most common benign neoplasm.

Conclusion: The types of adnexal lesions detected during pregnancy (non-neoplastic and neoplastic; benign, borderline, or malignant), their frequencies, and the gestational trimester at diagnosis were consistent with the published literature. Functional ovarian cysts were the leading cause of adnexal masses during the first trimester, whereas neoplastic lesions were more frequently encountered during the second and third trimesters. Mature cystic teratoma was the most common benign neoplasm. Borderline and malignant lesions were uncommon. Treatment-related conditions and uterine anatomical anomalies should also be considered in the differential diagnosis because they may mimic adnexal masses during pregnancy.

Keywords

pregnancy, ovarian cysts, ovarian neoplasms, abdomen, acute

DOI: 10.4328/ACAM.50284

Ann Clin Anal Med 2026;17(9): 988-992

Received: 08.07.2026

Accepted: 15.08.2026

Published Online: 15.08.2026

Printed: 01.09.2026

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Introduction

Routine obstetric ultrasonography performed for fetal anomaly screening has led to an increased detection of adnexal masses during pregnancy in recent years.¹ Most adnexal masses are identified incidentally during routine antenatal examinations.² The reported incidence of adnexal masses during pregnancy ranges from 0.05% to 3.2% of live births.³ Because the ovaries are more readily visualized during the first trimester, most adnexal masses are diagnosed at this stage of pregnancy.⁴ Approximately 70% of these lesions are benign functional ovarian cysts that resolve spontaneously without intervention.³

Symptomatic patients most commonly present with abdominal pain and vaginal bleeding. However, a subset of patients may develop an acute abdomen secondary to complications such as cyst rupture, hemorrhage, ovarian torsion, or mass effect. While some lesions regress spontaneously during follow-up, others require emergency surgical intervention. Persistent adnexal masses are associated with a higher risk of complications than lesions that resolve spontaneously.⁵

Although the evaluation and management of adnexal masses in nonpregnant women are well established, the optimal approach to adnexal masses detected during pregnancy remains controversial.³ Adnexal masses in pregnancy represent a clinically important diagnostic and therapeutic challenge because pregnancy-related physiological and anatomical changes may complicate their evaluation. At the same time, management decisions must simultaneously consider maternal and fetal well-being. Conservative management carries the potential risk of complications, including labor obstruction, cyst rupture, ovarian torsion, and, in rare cases, delayed diagnosis of malignancy.⁶ Conversely, surgical intervention is associated with maternal and fetal risks, including hemorrhage, injury to adjacent organs, infection, anesthesia-related complications, preterm labor, fetal loss, and uterine injury. Therefore, accurate characterization of these lesions and appropriate clinical management are important to avoid unnecessary intervention while identifying patients who may require surgery.

Assess the risk of malignancy through a comprehensive evaluation that integrates ultrasonographic findings, magnetic resonance imaging (MRI) in cases with inconclusive ultrasonographic findings or suspected malignancy, clinical follow-up, and, when appropriate, serum tumor markers. In the absence of findings suggestive of malignancy, conservative management with close surveillance is generally recommended.²

Because adnexal masses detected during pregnancy encompass a heterogeneous spectrum ranging from transient functional cysts to benign, borderline, and malignant neoplasms, characterizing their clinicopathological spectrum by gestational period may contribute to differential diagnosis and clinical management. Furthermore, adnexal lesions may present with acute abdominal symptoms. At the same time, gynecological and non-gynecological conditions constitute an important part of the differential diagnosis of acute abdomen during pregnancy, further complicating clinical assessment. Accordingly, this study aimed to characterize the clinicopathological spectrum of lesions encountered in pregnant women presenting with acute abdomen or incidentally detected adnexal masses during routine antenatal follow-up and to evaluate their distribution by gestational trimester. We also aimed to describe the relative frequencies of non-neoplastic and neoplastic lesions and their clinical course when follow-up data were available.

Materials and Methods

Study Design

This retrospective observational study included pregnant women evaluated between 2013 and 2020 in the Departments of General Surgery and Obstetrics and Gynecology at the University of Health Sciences, İzmir Faculty of Medicine, Tepecik Training and Research Hospital. Hospital electronic medical records were retrospectively reviewed to identify pregnant women who either presented with acute abdomen during pregnancy or had an adnexal mass incidentally detected during routine antenatal clinical and radiological examinations. Clinical, radiological, follow-up, and histopathological data, when available, were retrospectively reviewed.

For each patient, maternal age, gestational trimester and gestational week at presentation or diagnosis, mode of presentation, and available clinical and radiological findings were recorded. In patients with adnexal lesions, the clinical course of the lesion (regression, persistence, or progression) was evaluated based on the available follow-up records. In surgically treated patients, the surgical procedure and postoperative histopathological diagnoses were reviewed.

Inclusion and Exclusion Criteria

Pregnant women were eligible for inclusion if they met at least one of the following criteria: (1) incidental detection of an adnexal mass during routine antenatal clinical or radiological examination or (2) presentation with acute abdomen during pregnancy. Patients with ectopic pregnancy were excluded because the study population was restricted to women with an ongoing pregnancy.

Ethical Approval

Ethical approval for this study was obtained from the Non-Interventional Research Ethics Committee of the University of Health Sciences, İzmir Faculty of Medicine, Tepecik Training and Research Hospital (Approval No. 2022/07-22).

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 24.0 (IBM Corp., Armonk, NY, USA). Because of the study's retrospective observational design, only descriptive statistical analyses were performed. Continuous variables are presented as median and range (minimum–maximum), whereas categorical variables are expressed as numbers (n) and percentages (%). No comparative statistical analyses were performed.

Reporting Guidelines

This retrospective observational study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.

Results

A total of 44 pregnant women with a median age of 28.5 years (range, 18–42 years) were included in the study. Ten patients presented during the first trimester, 24 during the second trimester, and 10 during the third trimester.

Among the 10 patients who presented during the first trimester, eight had simple or complex ovarian cysts ranging from 1.4 to 9 cm in diameter. Most of these cysts regressed during clinical and radiological follow-up. Of the remaining two patients, one was diagnosed with an incidental grade 1 neuroendocrine tumor detected during surgery for acute appendicitis, while the other had a borderline seromucinous tumor.

Among the 24 patients who presented during the second trimester, appendectomy was performed in nine cases. Histopathological

examination revealed acute appendicitis in six patients and reactive lymphoid hyperplasia in three. In addition, four patients were diagnosed with mature cystic teratoma, one with a granulosa cell tumor, one with mucinous cystadenofibroma, one with endometrioma, one with ovarian hyperstimulation syndrome (OHSS), which regressed during pregnancy, and two with simple ovarian cysts. The simple cysts resolved during follow-up. Clinical follow-up data were unavailable for five patients.

Among the 10 patients who presented during the third trimester, three were diagnosed with acute calculous cholecystitis, two with acute appendicitis, and one each with ileocecal intussusception, mucinous cystadenoma, and borderline serous tumor. One patient was under follow-up for polycystic ovary syndrome, while another was diagnosed with uterus didelphys (Table 1).

Table 1. Distribution and Frequency of Adnexal Masses Detected During Pregnancy.

Gestational trimester	Diagnosis	n (%)
First trimester (n = 10)	Simple/complex ovarian cyst	8 (80)
	Acute appendicitis	1 (10)
	Borderline seromucinous tumor	1 (10)
Second trimester (n = 24)	Acute appendicitis	9 (37.5)
	Mature cystic teratoma	4 (16.7)
	Simple ovarian cyst	2 (8.3)
	Mucinous cystadenofibroma	1 (4.2)
	Endometrioma	1 (4.2)
	Ovarian hyperstimulation syndrome (OHSS)	1 (4.2)
	Granulosa cell tumor	1 (4.2)
Third trimester (n = 10)	Acute calculous cholecystitis	3 (30)
	Acute appendicitis	2 (20)
	Intussusception	1 (10)
	Mucinous cystadenoma	1 (10)
	Borderline serous tumor	1 (10)
	Polycystic ovary syndrome (PCOS)	1 (10)
	Uterus didelphys	1 (10)

Overall, functional ovarian cysts that regressed during follow-up were the most common lesions detected in the first trimester. During the second trimester, acute appendicitis and mature cystic teratoma predominated, whereas presentations related to simple ovarian cysts became less frequent. In the third trimester, most cases were associated with acute calculous cholecystitis and acute appendicitis.

Mature cystic teratoma was the most common benign neoplasm, followed by mucinous cystadenoma and mucinous cystadenofibroma. Malignant or borderline lesions were uncommon and included one borderline serous tumor, one borderline seromucinous tumor, and one juvenile granulosa cell tumor.

Discussion

Routine obstetric ultrasonography has led to increased detection of adnexal masses during pregnancy. MRI may be useful when lesions are too large to be adequately evaluated by ultrasonography or when imaging findings raise suspicion for malignancy.^{5,7} In

such cases, conservative management with close surveillance is generally recommended, whereas surgical intervention should be considered when malignancy is suspected. When surgery is indicated, the second trimester is considered the optimal period because it minimizes the risks of miscarriage and preterm delivery.⁸ During the third trimester, if malignancy is not suspected, elective surgery may be deferred until cesarean delivery or the postpartum period.

Adnexal masses detected during pregnancy may arise from gynecologic or non-gynecologic conditions. Gynecologic causes include pregnancy-specific entities, such as hyperreactio luteinalis (HL) and OHSS, as well as benign and malignant ovarian neoplasms and extraovarian gynecologic conditions, including leiomyoma, tubo-ovarian abscess, and paratubal cysts. Non-gynecologic causes primarily include appendicitis, cholecystitis, and diverticular abscesses.³

Among these conditions, functional ovarian cysts, including corpus luteum and follicular cysts, represent the most common non-neoplastic adnexal lesions during pregnancy. Lesions measuring <5 cm usually regress spontaneously before the 16th week of gestation. Most cystic ovarian lesions detected by ultrasonography during pregnancy are corpus luteum cysts.⁹ The corpus luteum develops following ovulation and produces progesterone until the placenta begins producing progesterone. Failure of corpus luteum regression after approximately nine weeks of gestation may result in corpus luteum cyst formation. Follicular cysts also develop secondary to hormonal changes during pregnancy. Hemorrhage into these cysts may lead to the formation of hemorrhagic cysts, which are frequently encountered during pregnancy. Theca lutein cysts, which develop in association with markedly elevated beta-human chorionic gonadotropin (β-hCG) levels, such as those observed in molar pregnancy, fetal hydrops, or multiple gestation, should also be considered in the differential diagnosis.³

Endometriomas and teratomas are also common cystic adnexal lesions encountered during pregnancy. Endometriomas often regress or disappear spontaneously during gestation, although rupture may rarely occur, resulting in an acute abdomen that necessitates emergency surgery.¹⁰ Although ultrasonography is usually sufficient for diagnosis, definitive diagnosis requires histopathological confirmation of endometrial glands and stroma. After the 16th week of gestation, mature cystic teratoma becomes one of the most common persistent adnexal masses. Mature cystic teratomas, including benign dermoid cysts, are benign neoplasms with an estimated malignant transformation rate of approximately 2%. They are typically unilateral, slow-growing tumors. However, younger patient age, bilateral involvement, and larger tumor size warrant closer follow-up.¹¹ Consistent with previous reports, acute appendicitis and mature cystic teratoma were the most frequent diagnoses among patients presenting during the second trimester in our series. In contrast, presentations related to simple ovarian cysts became less common.

The incidence of malignancy among adnexal masses detected during pregnancy is very low, with malignant ovarian tumors complicating only 1 in 15,000–32,000 pregnancies.⁶ Approximately 40% of these malignant tumors are germ cell tumors, with dysgerminoma representing the most common subtype.³ Sex cord-stromal tumors and borderline epithelial tumors may also occur.¹²

In a large retrospective study including 9,375 pregnant women, adnexal masses were identified in 0.19% of pregnancies, with a malignancy rate of 0.93%. Approximately 39.1% of malignant tumors were of germ cell origin.⁵ Similarly, a narrative review of

studies published between 2000 and 2017 reported an overall malignancy rate of approximately 5% among adnexal masses detected during pregnancy, with germ cell tumors accounting for nearly 40% of malignant cases.³ In our series, borderline or malignant lesions were uncommon. They were identified in three of the 44 patients (6.8%), including one borderline serous tumor, one borderline seromucinous tumor, and one juvenile granulosa cell tumor. In our cohort, epithelial ovarian neoplasms were more frequent than germ cell tumors.

Pregnancy-related hormonal changes may substantially alter the morphology and cytological features of adnexal lesions, occasionally mimicking malignancy.¹³ Large solitary luteinized follicle cysts, HL, and pregnancy luteoma are well-recognized pregnancy-associated lesions that may simulate ovarian neoplasms.¹⁴ Bilateral theca-lutein cysts characterize HL and are commonly associated with markedly elevated β -hCG levels, as seen in gestational trophoblastic disease, multiple gestation, or fetal hydrops. Less frequently, HL may be associated with maternal virilization, gestational diabetes mellitus, preeclampsia, and thyroid disorders.¹⁵ On ultrasonography, HL typically presents as bilaterally enlarged multicystic ovaries without solid components. Histopathologically, it is characterized by multiple cystic follicles lined by granulosa cells and luteinized theca interna cells embedded within an edematous stroma.¹⁶

OHSS should also be considered in the differential diagnosis of bilateral multicystic ovarian enlargement during pregnancy. Clinical history is particularly helpful in distinguishing OHSS from HL. Markedly elevated β -hCG levels together with bilateral ovarian enlargement favor the diagnosis of HL. Pregnancy luteoma represents another benign pregnancy-associated lesion that may mimic ovarian malignancy on imaging studies. It is most frequently detected incidentally near term, during cesarean delivery, or in the postpartum period. Histologically, pregnancy luteoma consists of hyperplastic nodules composed of luteinized ovarian cells with abundant eosinophilic cytoplasm and follicle-like spaces.¹⁴

Accurate differentiation between malignant ovarian tumors and pregnancy-related tumor-like lesions requires careful integration of clinical history, radiological findings, serological findings, and histopathological examination. In our granulosa cell tumor case, the absence of characteristic clinical features of HL or OHSS, unilateral ovarian involvement, persistence of the lesion during follow-up, a normal contralateral ovary, and β -hCG levels appropriate for gestational age all supported the diagnosis of granulosa cell tumor rather than pregnancy-associated luteinizing lesions.¹⁵

Limitations

This study has several limitations. The retrospective single-center design and the relatively small sample size may limit the generalizability of the findings. In addition, long-term clinical follow-up data were unavailable in the electronic medical records for some patients.

Conclusion

In this study, the types of adnexal lesions detected during pregnancy (non-neoplastic and neoplastic; benign, borderline, or malignant), their frequencies, and the gestational trimester at which they were detected were consistent with the published literature. Functional ovarian cysts were the leading cause of adnexal masses during the first trimester. In contrast, neoplastic lesions were more frequently encountered in the second and third trimesters, most of which were benign. In addition, treatment-related conditions, such as

OHSS and HL, as well as uterine anatomical anomalies, may mimic adnexal masses during pregnancy.

Declarations

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent

Written informed consent was not obtained due to the retrospective nature of the study.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare no conflict of interest.

Funding

None.

Author Contributions (CRediT Taxonomy)

EA: Investigation, Visualization, Resources, Writing – Original Draft.
CKT: Conceptualization, Methodology, Writing – Review & Editing, Supervision, Project Administration.
MG: Conceptualization, Methodology, Supervision, Project Administration.
SS, ADT, BC, GK, GA, CSP: Investigation, Validation, Resources, Writing – Review & Editing.

AI Usage Disclosure

ChatGPT (OpenAI) was used solely to assist with English-language translation of the manuscript. No artificial intelligence tool was used for study design, data analysis, interpretation of the results, or scientific decision-making. The authors reviewed, revised, and approved the scientific content and final version of the manuscript.

Abbreviations

HL: Hyperreactio luteinalis
MRI: Magnetic resonance imaging
OHSS: Ovarian hyperstimulation syndrome
STROBE: Strengthening the reporting of observational studies in epidemiology

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How to Cite

Eylül Altınağız, Serhat Sarıkaya, Anıl Doğan Tural, Canan Kelten Talu, Ceren Sağlam Purut, Gizem Kılınç, Göksever Akpınar, Behzat Can, Mehmet Gökçü. Adnexal masses during pregnancy. *Ann Clin Anal Med* 2026;17(9):988-992. doi:10.4328/ACAM.50284