

RESEARCH ARTICLE

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Ovarian Tumors during Pregnancy and Adverse Pregnancy Outcome: A Retrospective Analysis

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Abstract

Objective: To determine the prevalence of ovarian tumor in pregnancy. **Materials and Methods:** A retrospective descriptive study was conducted using electronic data from Obstetrics and Gynecology Department at Bhumibol Adulyadej Hospital (BAH), Royal Thai Air Force, Thailand recorded between January 2012 and December 2022. The participants were patients diagnosed with ovarian tumors during pregnancy (OTP) within the study period. Demographic characteristics, histopathological findings, ultrasonography results and pregnancy outcomes were recorded. **Results:** A total of 190 OTP cases were identified among 41,842 pregnant women. One hundred twenty-six OTP cases underwent surgery during pregnancy. The mean age of the participants was 29.6 years. The prevalence of ovarian tumors was 4.5(190/41,842) in 1000 pregnancies. Malignant ovarian tumors accounted for 0.14% (2/126). Histopathological analysis revealed that germ cell ovarian tumors and common epithelial ovarian tumors were found in 50.79% (64/126) and 49.2% (62/126) of cases, respectively. Most germ cell ovarian tumors were mature cystic teratomas, which were found in 98% (63/64) of cases. One-third (32/126) of the OTP cases underwent surgery during the second and early third trimesters. Fetal loss following surgery occurred in 18.75% (6/32) of cases. Adnexectomy performed with cesarean delivery and after vaginal delivery occurred in 93 and 1 cases, respectively. Symptomatic OTP leading to emergency surgery was observed in 6.84% (13/190) of cases. **Conclusion:** The prevalence of OTP was 4.5 per 1,000 pregnant women. Fetal loss during surgery in pregnancy occurred in 18.75%. Mature cystic teratoma was the common histopathological finding.

Keywords: Ovarian tumor- cancer- pregnancy

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Introduction

The incidence of ovarian tumor (OT) ranged from 5 to 15 percent [1]. One-quarter of OT presented in reproductive age women. Nearly two-thirds occurred in women between 20 and 40 years old. The most common type of OT is benign [1, 2]. Most OT were asymptomatic or presented with non-specific symptoms. [1, 3].

The incidence of OT during pregnancy ranged from 0.1 to 0.8% [4-6]. Most of cases were diagnosed incidentally during ultrasonography in the first trimester. The management of ovarian tumor in pregnancy included surveillance with ultrasonographic imaging until the second trimester of pregnancy [7]. The management of OT in pregnancy depended on the provisional diagnosis, based on either ultrasound findings or clinical manifestation [8]. Persistent of OT more than 10 cm. in the second trimester was an indication for surgery. By that time, progesterone was already synthesized from placenta rather than the corpus luteum cyst of pregnancy. Conservative ovarian

surgery is easier to perform at this stage, which is another reason for opting for surgery at that time. [3].

This investigation aimed to determine the prevalence of OT in pregnancy and its associated adverse pregnancy outcomes. A secondary aim was to compare ovarian histopathology and preoperative ultrasonographic finding of germ cell ovarian tumor and common epithelial tumors.

Materials and Methods

A retrospective descriptive study was conducted using medical records from Obstetrics and Gynecology Department at Bhumibol Adulyadej Hospital (BAH), Royal Thai Air Force, Bangkok, Thailand between January 2012 and December 2022. This study was approved by the BAH Institutional Review Board in 2023 (IRB No.40/66).

The participants were pregnant women with OT who underwent tumor resection (oophorectomy or ovarian cystectomy) and received pathological examination at BAH. The database was reviewed using electronic

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hospital records to collect the participants' information. The inclusion criteria were patients with OT during pregnancy who underwent tumor resection and obtained a pathological examination at BAH. The exclusion criteria were incomplete data. The demographic data collected included age, underlying diseases, body weight, height, gestational age at tumor resection, and parity. Tumor pathologic reports were collected and analyzed. Sonographic characteristics and size of OT were assessed for correlation with their respective pathologic reports. Furthermore, information on route of delivery, neonatal birthweight, and total blood loss during delivery were retrieved for evaluation.

The sample size was calculated using the one-proportion formula. The prevalence of OT in pregnancy was 0.01 percent [3]. Alpha and beta error were set at level of 0.01 and 0.05, respectively. The margin of error was set at 0.001 level. The appropriate sample size for this study was 38,031 cases with an additional ten percent compensation for data loss. The final sample size in the current study was 41,832 cases.

The Statistical Package for the Social Science (SPSS) version 18 (IBM, Armonk, NY, USA) was used for statistical analysis. Descriptive statistics, including distribution, percentages, mean, and standard deviation (SD), were used to calculate the prevalence. The Chi-square or Man-Whitney U test was used for the analysis of category data as appropriate. A p-value of 0.05 was considered statistically significant.

Results

During the period of study from 2012 to 2022, there were 41,842 pregnant women visiting BAH hospital. One hundred and ninety cases of ovarian tumor were diagnosed and treated. After considering the exclusion criteria, 126 pregnant women were recruited. The prevalence of ovarian tumor during pregnancy in this study was 4.5 in 1,000 (190/41,842) pregnant women as shown in Figure 1.

There were 64 and 62 cases of germ cell ovarian tumor (GCOT) and common epithelium ovarian tumor (CEOT) in pregnancy, respectively. All cases underwent exploratory laparotomy. Mean age and body mass index (BMI) of participants were 29.6 ± 6.6 years and 28.2 ± 5.9 kg/m², respectively. Most participants (111/126) had no underlying diseases. Two-thirds (73/126) were nulliparous. One-fourth (32/126) of OT in pregnancy were diagnosed before 28 weeks of gestational age. Three-quarters (90/126) of cases underwent ovarian cystectomy. There was no statistically significant of age, BMI, GA less than 28 weeks, parity and type of ovarian histopathology between subjects who underwent ovarian cystectomy and salpingo-oophorectomy as shown in Table 1. Both groups (GCOT and CEOT) had comparable demographic characteristics as presented in Table 1.

From ultrasound findings, the mean size of ovarian tumors was 83.6 ± 35.8 mm. in diameter. Bilaterality of OT was 4 (5/126) percent. One-quarter (35/126) of OT was uni-loculated pattern identified from ultrasound. There

Table 1. Clinical and Histological Characteristics of Pregnancy with GCOT(n=64) and CEOT(n=62)

	Total	GCOT*	CEOT*	p-value
Age (years)	29.6±6.6	29.7±7.3	29.5±6.0	0.87
BMI (kg/m ²)	28.2±5.9	28.0±6.4	28.4±5.6	0.75
No U/D**	111 (88.1)	55 (85.9)	56 (90.3)	0.59
GAS< 28 weeks **	32 (25.4)	14 (21.9)	18 (29.0)	0.47
Nulliparity **	73 (57.9)	35 (53.7)	38 (61.3)	0.45
Ultrasound**	40 (31.7)	19 (29.7)	21 (33.9)	0.61
Size (mm)	83.6±35.8	80.4±34.7	86.2±37.3	0.63
Unilocular**	35 (27.7)	17 (26.5)	18 (29.0)	0.75
Bilateral**	5 (4.0)	2 (3.1)	3 (4.8)	0.24
Size (mm)	67.0±39.0	67.0±29.0	66.9±47.3	0.98
Ovarian cystectomy**	90 (71.4)	44 (68.8)	46 (74.2)	0.42
C/S & adnexectomy**	81 (81.8)	48 (88.9)	33 (73.3)	0.045
NBW(g)	3,064± 634	3,071±640	3,039±634	0.86
EBL (ml)	479±339	489±337	475±343	0.9
Histopathology				
Teratoma		63		
Dysgerminoma		1		
Mucinous			16	
Serous			7	
Endometrioma			20	
Physiologic cyst	18			
Clear cell cancer			1	

*mean ± standard deviation (SD), **n (%), GCOT, germ cell ovarian tumor; CEOT, common epithelial ovarian tumor; BMI, body mass index; U/D, underlying disease; GAS, gestational age at surgery; C/S, cesarean delivery; NBW, neonatal birth weight

Table 2. Comparison of the Current Study to the Previous Literatures in Ovarian Tumor during Pregnancy

	Present	Gasim	Koo	Testa	Zhang	Bruno	Naing
Year	2024	2010	2013	2020	2021	2023	2023
Country	Thai	Saudi Arabia	Taiwan	Italy	China	Italy	Japan
Case(n)	126	94	102	65	228	17	126
Population (n)	41,842	47,486	17,586				10,802
Prevalence (%)	0.45	0.2	0.5				0.8
Age (years)	29.6	27.2	30	33	30.8	33	30.5
BMI (kg/m ²)	28.2		22.1				20.4
Nullipara	57.9	18.1		59.3		88.2	
GAD (weeks)	31.8			11		10	
GAS (%)				23		39	13.1
T1/T2	24.6	69.2	74	N	25.4	41.2	100
Term	75.4	25.6	24	N	87.7	58.8	
Epithelium OT							
Teratoma	39.4	26	26	28.9	28	29.4	83.3
Mucinous	12.7	20	20	8.7	8.8	2.3	4.2
Serous	5.5	2.1	24	21.5	14.9		8.2
Endometrioma	15.8	16	16	14.9	14.9	5.8	
Malignancy	0.14	1.9	4	4	1.8	0.01	0.01
U/S finding	Y		Y	Y	Y	Y	
Complication (%)							
FLAS	18.8 (6/32)	5.3 (5/94)	17.6 (18/102)	7.7 (5/65)			
Twist	7.1	3.9	8 (4/50)		9.6	5.6	3.9

BMI, body mass index; GAD, gestational age at diagnosis; GAS, gestational age at surgery; T1/T2, first and second trimester; U/S, ultrasound; FLAS, fetal loss after surgery

were no statistically significant ultrasound features namely diameter, unilocular appearance, side of OT, ascites, solid area between the two groups.

Most cases (81/126) underwent ovarian cystectomy or salpingo-oophorectomy concurrent with cesarean delivery. One-third (44/126) underwent ovarian surgery before term. One-fourth of cases (11/44) presented to the hospital and were diagnosed of ovarian cysts with complications

(e.g. twist, torsion and rupture). Only one case was incidental discovered after immediate vaginal delivery.

Among GCOT, 63 and one cases had pathological report of mature cystic teratoma and dysgerminoma, respectively. One-third (20/62) of CEOT were diagnosed as endometriotic cysts. Physiologic cyst of pregnancy was diagnosed at 30 (18/62) percent. There were 16 and 7 cases of mucinous and serous cystadenoma, respectively.

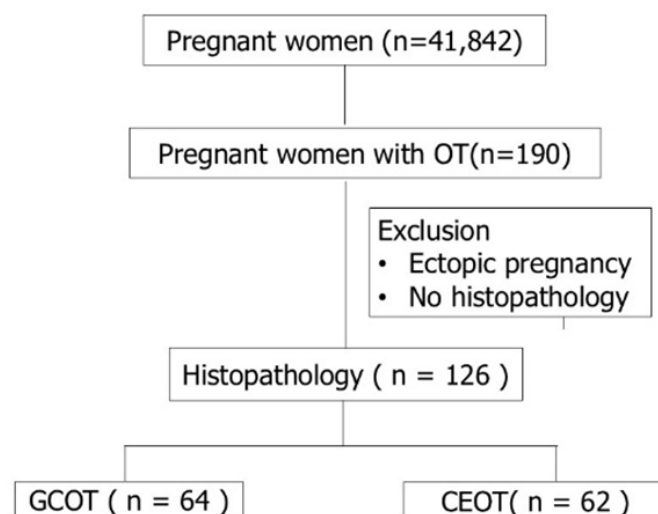


Figure 1. Flow of Study. OT, ovarian tumor; GCOT, germ cell ovarian tumor; CEOT, common epithelium ovarian tumor

There were two cases of ovarian cancer (clear cell, dysgerminoma histopathology). There were 6 cases of fetal loss after ovarian surgery before term. Fetal loss from surgery was 18.75 (6/32) percent. Maternal and neonatal outcomes are presented in Table 1.

Discussion

In the current study, the prevalence of OT was 0.45 percent. Previous reports showed the prevalence of OT during pregnancy ranged from 0.2 to 0.8 percent [4-6]. Mature cystic teratoma (39 percent) was the most common pathologic finding in this study. Previous data reports showed the prevalence of mature cystic teratoma during pregnancy ranging from 10.6 to 28.9 percent [4, 5, 7, 9, 10]. The finding in the present study was higher than the previous studies.

Nearly 60 percent of participants in our study were nulliparous pregnant women. A study from Saudi Arabia in 2010 reported that only 18 percent of OT during pregnancy were from nulliparous pregnant women [4]. Other literatures reported that nulliparity of OT in pregnancy ranged from 59.3 to 88.2 percent [7, 10]. Most OT cases in pregnancy from current investigation was benign. OT should be diagnosed during the first antenatal care period. The high percentage of multiparity among OT during pregnancy in our investigation indicated lack of OT detection during annual gynecologic examination either no attention or missing. Implementing checklist guideline and encouraging early ultrasound screening for OT in first antenatal routine visit should be prioritized.

A quarter of the patients in the current study was diagnosed with OT during the first half of their pregnancies. These patients underwent ovarian surgery during either the first or second trimester of their gestation. The detection rate of OT during the first and second trimester of gestation ranged from 25.4 to 100 percent [4-6, 9, 10].

A Japanese study conducted in year 2023 reported that all participants with OT during pregnancy underwent laparoscopic ovarian surgery during either the first or second trimester [6]. The percentage of ovarian surgeries conducted during the first and second trimester were 74, 69.2, 41.2 and 25.4 from Taiwan, Saudi Arabia, Italy and China, respectively [4, 5, 9, 10]. Even through the ultrasound screening during the first and second trimester of pregnancy were routine performed [3], the rates of ovarian surgery reported by Koo's, Gasim's, Bruno's and Zhang's studies during the first and second trimester did not reach 100 percent. This appears to be a common finding in most studies.

The operator dependent character of ultrasonography and the timing of the ultrasound were important factors in the early and accurate diagnosis of OT during pregnancy. Encouraging consistent ultrasonographic practice should be help achieve a 100 percent detection rate.

A comprehensive ultrasound study during pregnancy aimed to identify the number, location, anomaly of the fetus as well as abnormal gynecologic findings. In OT patients, early ovarian surgery was preferable to waiting until term and performing surgery concurrently with

cesarean delivery.

In the current study the most common finding of ovarian histopathology study was mature cystic teratoma at 39.4 percent. This finding was in lieu with the previous studies that ranging between 26 to 29.4 percent [4, 5, 7, 9,10]. Only the Japanese study reported mature cystic teratoma at 83.3 percent [6]. Endometriotic cyst of ovary during pregnancy in the current study was 15.8 percent. Amount previous studies, endometriotic cyst of ovary during pregnancy prevalence was ranging between 5.8 and 16 percent [4-7, 9]. A comparison of this study to the previous studies were summarized in Table 2. However, most of the previous studies and current study had benign ovarian histopathology.

The prevalence of ovarian cancer during pregnancy in the current study was 0.14 percent. Previous studies reported a prevalence of ovarian cancer during pregnancy ranging from 0.01 to 4 percent [4-7, 9, 10]. The prevalence of ovarian cancer in pregnancy of the current study was low similar to those of the previous studies. [4-7, 9, 10]. Ovarian cystectomy (conservative manner) during pregnancy should be performed than oophorectomy (aggressive manner).

Not all of OT during pregnancy were diagnosed and underwent ovarian surgery during either the first or second trimester [3]. Missed diagnosis of OT during pregnancy consequently resulted in ovarian surgery at the same time as cesarean delivery or an immediate ovarian surgery right after vaginal delivery. The complication of OT during pregnancy ranged from 3.9 to 9.6 percent [4-6, 9,10]. OT complication for the current study was at the same rate with the previous studies.

Surgery during the first and second trimester carries the risk of fetal loss after surgery (FLAS). The FLAS rate in the current study was rather high at 18.8 (6/32) percent, compared to previous studies which reported rates between 5.3 and 17.6 percent [4, 5, 7]. Large enough abdominal incision (adequate exposure) during surgery, gentle uterine manipulation, short duration of anesthesia and tocolytic prevention were appropriate management of ovarian surgery during pregnancy to reduce the fetal loss after surgery [1]. Strength of the current study was the single center study and the long span period of data collection. Low incidence of ovarian cancer and the loss follow up of OT during pregnancy were the limitations of this study.

In conclusion, the prevalence of OTP was 4.5 per 1,000 pregnant women. The fetal loss rate for surgery during pregnancy was 18.75 percent. Mature cystic teratoma was the most common histopathological finding. The prevalence of ovarian cancer during pregnancy was relatively low at 0.14 percent. Conservative ovarian surgery during the first and second trimester is recommended as a routine practice.

Author Contribution Statement

K.R and W.L. designed the research; collected, summarized, and analyzed clinical data; and wrote the paper. W.L. is the corresponding author; B.S., K.S. and K.B. collected the data, wrote and approved the final

version for publication, and gave critique. All authors read and approved the final manuscript.

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Ethical approval

This study was approved by the Bhumibol Adulyadej Hospital, Institutional Review Board in 2023 (IRB No.40/66).

Availability of data

The data was controlled by hospital policy. Request of data depended on appropriate academic reason.

Conflict of interest

There was no conflict of interest in this study.

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