Original Research

Laparoscopic Treatment of Ovarian Pregnancy: A Series of 16 Consecutive Cases

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Abstract

Background: Ovarian pregnancy (OP) is a rare type of ectopic pregnancy (EP) that can become life-threatening due to the risk of severe complications, such as pelvic hemorrhage and circulatory collapse. The diagnosis and treatment of OP are challenging. Thus, this study aimed to investigate the clinical characteristics of OP, explore current and potential diagnostic and therapeutic strategies, and summarize the experience with laparoscopic treatment for OP. **Methods**: A retrospective analysis was performed on data from 16 consecutive patients with OP who underwent surgical treatment between March 2016 and May 2025. We collected clinical data from these patients, including sociodemographic information, suspected risk factors, clinical manifestations, preoperative examinations [e.g., serum beta human chorionic gonadotropin (β-hCG) test and ultrasonography], treatment methods, and outcomes. **Results**: The mean age of the patients was 32.44 ± 6.37 years, and the mean gestational age at diagnosis was 50.13 ± 9.91 days. Abdominal pain was the most common presenting symptom (reported in 15 patients, 93.75%), followed by vaginal bleeding (7 patients, 43.75%) and hemorrhagic shock (2 patients, 12.50%). Serum β-hCG (measured in 15 patients) ranged from 700.56 to 12,661.89 mIU/mL, with a median of 4756.03 mIU/mL [interquartile range (IQR), 1730.39–8174.70 mIU/mL]. The preoperative ultrasound diagnostic rate for OP was 6.25% (1/16). All patients underwent laparoscopic surgery for the excision of OP tissue. A ruptured OP was observed in 13 patients (81.25%). Hemoperitoneum ranged from 30 to 2000 mL, with a median of 900 mL (IQR, 350–1000 mL). The mean operative time was 1.23 ± 0.60 h, and the mean postoperative hospital stay was 2.50 ± 1.51 days. None of the patients required additional surgical or medical treatments after laparoscopy (LC). **Conclusions**: Rupturing is a common complication of OP, highlighting the importance of early diagnosis and timely intervention. Laparoscopic techniques facilitate the early detection and accurate diagnosis of OP. Laparoscopic surgery is a safe, effective, and minimally invasive treatment option for OP.

Keywords: ovarian pregnancy; ectopic pregnancy; laparoscopy

1. Introduction

Primary ovarian pregnancy (OP) is a rare subtype of ectopic pregnancy (EP) in which a fertilized egg implant is placed in the ovary [1]. OP accounts for approximately 1.14–3.12% of all EPs and only 0.09% of all pregnancies [2]. The reported incidence of OP is growing because of the evolution of transvaginal sonography and careful histological examination of ovarian tissues [3].

However, the diagnosis and management of OP remain challenging. One of the main reasons is its rarity and high likelihood of misdiagnosis as more common conditions, such as tubal pregnancy (TP) or rupture of the corpus luteum (CL) [4,5].

Despite its low incidence, OP can be life-threatening, similar to TP, because of the risk of severe complications, such as pelvic hemorrhage and circulatory collapse. Therefore, early diagnosis and timely intervention are critical for reducing morbidity and mortality.

Although laparoscopic surgery has increasingly become the preferred approach for managing OP, concerns remain regarding the potential for massive intra-abdominal bleeding following rupture, which may lead to a preference for laparotomy in some emergency situations [6].

This study aimed to analyze the clinical characteristics, ultrasound manifestations, and laparoscopic treatment of 16 patients with OP, explore the diagnosis and treatment strategies, and summarize the experience of applying laparoscopy (LC) for the treatment of OP.

2. Materials and Methods

2.1 Study Design and Data Collection

Between March 2016 and May 2025, 16 patients diagnosed with OP were admitted to our department. A retrospective analysis was conducted by reviewing their electronic medical records and searching a computerized hospital database containing coded entries for all cases of EPs. All cases labeled as "ovarian pregnancy" or "nontubal ectopic pregnancy" were manually reviewed. Patients who did not undergo surgical treatment or had incomplete clinical records affecting accurate diagnosis of OP were excluded from the study. Ultimately, 16 histologically confirmed OP cases were identified. None of the 16 OP cases had severe underlying diseases, such as coagulation disorders, nor a history of anticoagulant use.

Table 1. Sociodemographic information and suspected risk of OP (N = 16).

Case	Patient age (years)	Gestational age (days)	Menstrual cycle (days)	BMI (kg/m^2)	Gravidity	Parity	Suspected risk factors
1	21	43	30–31	31.96	0	0	Pelvic adhesions (intestine and posterior uterine wall)
2	28	51	30	16.42	0	0	Pelvic adhesions (intestine and pelvic peritoneum)
3	33	53 (36 days after IVF-ET)	30–35	26.57	0	0	Infertility, IVF-ET
4	42	61	30–60	26.71	4	2	Cesarean section twice, SA/IA twice, tubal inflammation, pelvic adhesions (bilateral adnexa with intestinal, and pelvic peritoneum)
5	42	47	30	20.20	3	1	SA/IA twice
6	25	50	45–60	21.37	0	0	None
7	37	45	28–30	20.70	2	1	SA/IA once
8	34	39	30	22.66	3	2	SA/IA once, cesarean section once, pelvic adhesions (intestine and pelvic peritoneum)
9	23	48	30	21.83	0	0	None
10	38	56	30	21.48	4	1	SA/IA three times, downward IUD shifting
11	29	59	30	20.70	0	0	None
12	35	33	28	20.31	4	1	SA/IA three times
13	33	49	28–30	18.67	0	0	Hysteroscopic endometrial polypectomy
14	35	49	30	21.83	2	1	Oral emergency contraceptives (levonorgestrel), SA/IA once
15	27	43	30	19.03	0	0	None
16	37	76	30–90	23.80	3	1	SA/IA twice
Mean	32.44 ± 6.37	50.13 ± 9.91	\	22.14 ± 3.71	\	\	\
Percentile							
Q1 (25%)					0	0	
Median	\	\	\	\	1	0.5	\
Q3 (75%)					3	1	

OP, ovarian pregnancy; BMI, body mass index; IVF-ET, *in vitro* fertilization-embryo transfer; SA, spontaneous abortion; IA, induced abortion; IUD, intrauterine device; N, number of cases.

This study was approved by the ethics committee of the First Affiliated Hospital, Zhejiang University School of Medicine, and all methods were conducted in accordance with the relevant institutional guidelines and regulations. The diagnostic gold standard for inclusion was intraoperative confirmation of OP supported by histopathological evidence of the pregnancy tissue. The data were entered and managed using WPS office (12.1.0.24034, Kingsoft Office Software Inc. Beijing, China). The normally distributed variables were presented as mean $\pm$ SD. The variables that did not meet the normality were summarized as median with interquartile range (IQR) [such as beta human chorionic gonadotropin (β-hCG) levels and hemoperitoneum volume]. Categorical variables were presented as numbers (percentages).

2.2 Data Parameters

The following clinical and demographic data were extracted from patient records: (1) sociodemographic information: age, body mass index (BMI), menstrual and pregnancy histories; (2) Suspected risk factors: history of smoking, prior EP, pelvic inflammatory disease, pelvic or abdominal surgery (including cesarean section, adnexal surgery, appendectomy, etc.), intrauterine procedures (e.g., abortions, hysteroscopic surgeries), contraceptive use, infertility (defined as the failure to achieve pregnancy after 12 months of regular unprotected sexual intercourse), assisted reproductive technology, pelvic adhesions, and ovarian endometrioma detected during surgery; (3) clinical presentation: gestational age at admission and primary symptoms (abdominal pain, vaginal bleeding, and hemorrhagic shock); and (4) preoperative investigations: initial serum β-hCG levels (mIU/mL) and transvaginal ultrasound (TVS) or transabdominal ultrasound (TAS) findings.

2.3 Surgical Management

Treatment decisions were made by the attending gynecologist based on the patient's clinical history, physical examination, ultrasound findings, β-hCG levels, hemodynamic status, and the laparoscopic proficiency of the surgical team. All procedures were performed by experienced gynecologists under tracheal intubation general anesthesia, adopting either the supine or lithotomy position. Intraoperative monitoring included continuous blood pressure, electrocardiogram, transcutaneous blood oxygen saturation, and partial pressure of end-tidal carbon dioxide. For all laparoscopic cases, a Veress needle was inserted through the umbilicus to establish pneumoperitoneum by insufflating CO_2 into the abdominal cavity. A 1.0 cm trocar was placed at the umbilicus for the laparoscope, while 0.5 cm trocars were inserted at the counter-McBurney's point and McBurney's point (or the midpoint between the counter-McBurney's point and umbilicus) for operative instruments. The gestational sac was carefully excised aided by bipolar cautery, followed by meticulous electrocoag-

ulation to achieve hemostasis while minimizing ovarian damage. When the ovarian wound was relatively large or achieving hemostasis through spot coagulation proved difficult, we used absorbable sutures to continuously suture the wound for hemostasis, aiming to minimize further thermal damage to the ovary. All procedures strictly adhered to hemostatic protocols and thorough clearance of hemoperitoneum.

The following intraoperative data were recorded: (1) the location of the OP; (2) presence of pelvic adhesions or ovarian endometriosis; (3) hemoperitoneum volume; (4) integrity of the ectopic gestational sac (EGS) (intact or ruptured); (5) duration of surgery; (6) Whether blood transfusion was required; and (7) postoperative length of hospital stay. The hemoperitoneum volume was calculated by subtracting the total volume of irrigation saline used from the total volume of fluid aspirated. After surgery, all patients were admitted for postoperative observation and recovery.

3. Results

Between March 2016 and May 2025, 16 patients with OP were diagnosed and treated at our institution. All patients underwent a physical examination, gynecologic ultrasonography (TVS or TAS), and routine laboratory investigations, including complete blood count. Detailed clinical data, including sociodemographic information such as general condition, pregnancy history, gestational age at admission, and suspected risk factors, are summarized in Table 1. The diagnostic information, including preoperative β-hCG level, ultrasound findings, main clinical symptoms are summarized in Table 2. The treatment information, including surgical method, intraoperative observations, whether a blood transfusion was required and postoperative hospital stay, is summarized in Table 3.

The mean age of the patients was 32.44 ± 6.37 years. Their mean BMI was 22.14 ± 3.71 kg/m^2. Their gravidity ranged from 0 to 4, with a median of 1 (IQR, 0–3), and parity ranged from 0 to 2, with a median of 0.5 (IQR, 0–1). The mean gestational age at admission was 50.13 ± 9.91 days. None of the patients reported a history of smoking. Eight patients had no prior pregnancies and none had a history of EP. Notably, one patient (6.25%) conceived through *in vitro* fertilization-embryo transfer (IVF-ET) because of primary infertility. One patient (6.25%) was pregnant with an intrauterine device (IUD) in place, which had shifted downward. Half of the patients (8/16, 50%) had a history of spontaneous or induced abortion. One patient (6.25%) had undergone hysteroscopic endometrial polyp resection, one (6.25%) had a history of salpingitis, and another (6.25%) had taken oral levonorgestrel emergency contraceptives before conception. Two patients (12.50%) had a previous cesarean section.

All patients underwent emergency laparoscopic surgery. One patient, who presented with life-threatening intraperitoneal bleeding, did not undergo a preoperative

Table 2. Diagnosis of OP (N = 16).

Case	β-hCG level (mIU/mL)	Pelvic ultrasound		Main clinical symptoms		
		Type	Main outcome	Abdominal pain	Vaginal bleeding	Shock
1	Not measured	TAS	EP mass considered	+	−	−
2	7454.60	TVS	EP mass considered	+	+	−
3	2370.00	TVS	EP mass considered	+	+	−
4	1730.39	TVS	EP mass considered	+	−	−
5	3143.10	TVS	EP mass considered	+	−	−
6	2147.69	TVS	Ruptured CL or EP mass indistinguishable	+	−	−
7	8912.95	TVS	Ruptured CL considered	+	−	+
8	6902.21	TVS	EP mass considered	+	+	−
9	6271.90	TVS	EP mass considered	+	+	−
10	8174.70	TVS	EP mass considered	+	+	−
11	4756.03	TVS	EP mass considered	+	−	−
12	8370.91	TVS	EP mass considered	+	−	−
13	12,661.89	TVS	EP mass considered	−	+	−
14	828.10	TAS	EP mass considered	+	−	+
15	700.56	TVS	EP mass considered	+	+	−
16	1643.48	TVS	OP mass considered	+	−	−
Percentile						
Q1 (25%)	1730.39					
Median	4756.03	\	\	\	\	\
Q3 (75%)	8174.70					

TAS, transabdominal ultrasound; TVS, transvaginal ultrasound; EP, ectopic pregnancy; CL, corpus luteum; β-hCG, beta human chorionic gonadotropin.
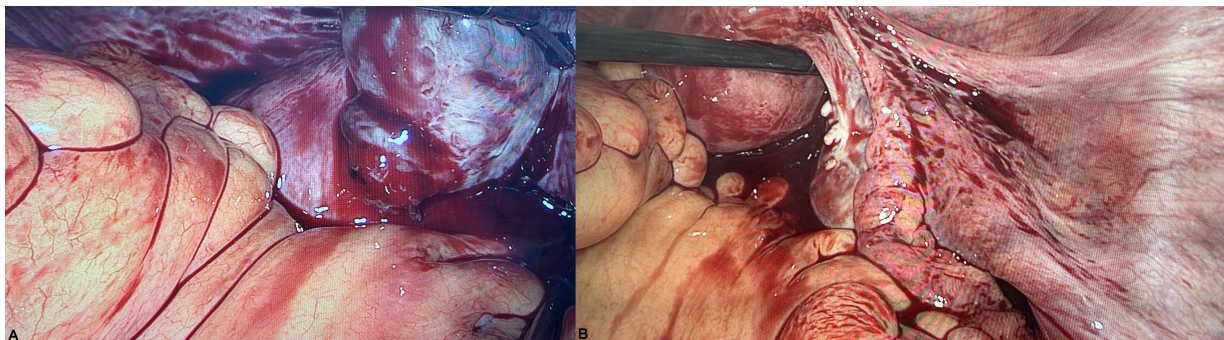

Fig. 1. Typical presence of the OP. (A) LC revealed a rupture of OP on the right side. (B) The right fallopian tube appeared normal.

β-hCG blood test but tested positive for urinary hCG in the emergency department. Among the remaining 15 patients, the serum β-hCG levels ranged from 700.56 to 12,661.89 mIU/mL, with a median of 4756.03 mIU/mL (IQR, 1730.39–8174.70 mIU/mL). Of these 15 patients, 13 (86.67%) had levels >1500 mIU/mL.

All patients were symptomatic at admission; 6 patients (37.50%) had symptoms of both abdominal pain and abnormal vaginal bleeding, 9 (56.25%) had abdominal pain without vaginal bleeding, and 1 (6.25%) presented with vaginal bleeding only. Abdominal pain was present in 15 patients (93.75%), and 7 (43.75%) experienced abnormal vaginal bleeding. Hemorrhagic shock occurred in 2 patients (12.50%, cases 7 and 14). All patients had a history of amenorrhea; however, three of them overlooked it due to previously irregular menstrual cycles. Preoperative ultra-

sonography identified abnormal adnexal or pelvic masses in all patients. EP was suspected in 14 patients (87.50%); one patient (case 16) showed a gestational sac-like structure with fetal cardiac activity within the ovary, leading to a preoperative diagnosis of OP. In the remaining 13 patients, although EP was suspected, its exact location could not be determined. One patient (case 7) was misdiagnosed as having a ruptured ovarian CL, and another (case 6) had indeterminate findings suggestive of either a ruptured CL or EP by ultrasound.

All patients (100%) underwent laparoscopic resection of the ectopic tissue. A typical intraoperative finding was the presence of an ovarian mass, as shown in Fig. 1. One patient (case 10) who no longer desired fertility underwent bilateral tubal sterilization and IUD removal during surgery. Postoperative pathology confirmed the diagnosis of OP in

Table 3. Treatment of OP (N = 16).

Case	Surgical procedure	Duration of surgery (h)	Integrity of the EGS	Hemoperitoneum (mL)	Side	Blood transfusion	Postoperative hospital stay (days)
1	LC/RGP	0.97	Ruptured	500	R	No	3
2	LC/RGP	1.65	Ruptured	1000	L	No	6
3	LC/RGP	2.35	Intact	50	L	No	5
4	LC/RGP	0.93	Ruptured	500	R	No	2
5	LC/RGP	2.52	Ruptured	1000	L	No	2
6	LC/RGP	1.33	Ruptured	1000	L	No	4
7	LC/RGP	1.43	Ruptured	1500	R	Yes	2
8	LC/RGP	1.13	Ruptured	800	L	No	4
9	LC/RGP	1.60	Ruptured	500	R	No	2
10	LC/RGP + tubal sterilization + IUD removal	1.48	Ruptured	1000	R	No	2
11	LC/RGP	0.53	Ruptured	1000	L	No	1
12	LC/RGP	0.60	Intact	100	L	No	1
13	LC/RGP	0.67	Ruptured	200	R	No	1
14	LC/RGP	1.07	Ruptured	2000	R	Yes	1
15	LC/RGP	0.72	Ruptured	1000	R	No	2
16	LC/RGP	0.63	Intact	30	L	No	2
Mean	\	1.23 ± 0.60	\	\	\	\	2.50 ± 1.51
Percentile							
Q1 (25%)				350			
Median	\	\	\	900	\	\	\
Q3 (75%)				1000			

EGS, ectopic gestational sac; LC, laparoscopy; RGP, removal of gestational products; R, right; L, left.

all the patients. The pregnancy was located in the left ovary in 8 patients (50%) and in the right ovary in the other 8 patients (50%). Obvious pelvic adhesions were present in 4 patients (25%). The main adhesion locations are shown in Table 1. Ovarian endometriosis was not observed.

Ruptured OP was observed in 13 patients (81.25%). Hemoperitoneum volume ranged from 30 to 2000 mL, with a median of 900 mL (IQR, 350–1000 mL) (Table 3). Two patients (12.50%, cases 7 and 14) underwent blood transfusions. The mean operative time was 1.23 ± 0.60 h, and the mean postoperative hospital stay was 2.50 ± 1.51 days. None of the patients required additional surgical or medical treatments after LC. All patients had their postoperative β-hCG levels monitored and returned to negative values within 1 month.

4. Discussion

OP is rare, and its underlying pathogenesis remains poorly understood. In this study, we explored the suspected risk factors for OP. One of the 16 patients with OP (6.25%) had an IUD in place, suggesting a potential association between IUD-induced aseptic uterine inflammation and OP through altered tubal peristalsis. Another patient (6.25%) conceived via IVF-ET because of infertility. Over half of the patients had a history of intrauterine procedures, whereas a few presented with obvious pelvic adhe-

sions intraoperatively; however, no ovarian endometriosis was observed. Apart from the two patients with prior cesarean sections, most had no history of pelvic or abdominal surgery. Some individual patients had a history of salpingitis or emergency contraceptive use. Notably, 25% of the patients had no identifiable risk factors. Some researchers have suggested that the increased risk of OP may be associated with factors such as previous abdominal surgery, history of infectious diseases, infertility, IVF-ET, use of IUD and emergency oral contraceptives, and ovarian endometrioma [5–10]. Among the various factors, the association between IUD use and IVF in OP is the most widely recognized or increasingly acknowledged [5,8,9,11]. Seinera et al. [12] speculated that traditional risk factors of TP are unrelated to those of OP. The etiology of OP remains uncertain; traditional TP risk factors, such as IUD use, pelvic surgery, infection, and assisted reproduction, did not show a significant association with OP in a previous study [13]. Given the rarity of OP and limited availability of large-scale studies, identification of definitive risk factors remains challenging. Current evidence suggests a multifactorial etiology. Further research with larger sample sizes is necessary to clarify the underlying mechanisms and establish validated risk profiles for OP.

The typical clinical presentation of OP includes amenorrhea, abdominal pain, and vaginal bleeding with or with-

out associated symptoms, such as anal distension. Rupture of OP may lead to more severe manifestations, including dizziness, syncope, and potentially hemorrhagic shock. In our study, up to 93.75% of the patients presented with abdominal pain, whereas less than half exhibited vaginal bleeding. Interestingly, patients with OP are less likely to present with vaginal bleeding, compared with those with TP, a difference attributed to the well-maintained endometrium and higher β-hCG levels seen in OP, likely due to enhanced vascularization of ovarian tissue [5]. Correspondingly, abdominal pain as the sole symptom is more common in OP than in TP [13].

The rupture rate of OP in our cohort was high (81.25%). Owing to the fragility of the ovarian surface, all 13 cases of OP rupture occurred in the early stages of pregnancy, leading to intra-abdominal hemorrhage and, in two cases, hemorrhagic shock. These clinical features closely resemble those observed in TP or rupture of the CL, making the differential diagnosis challenging. Patients with OP tend to experience more severe clinical complications during the first trimester, such as hemorrhagic shock, ruptured gestational sacs, hemoperitoneum, and an increased need for emergency laparotomy, compared with those with TP [8]. For example, one study observed a rupture rate of 56.34% in patients with OP, with significantly greater peritoneal blood accumulation than in patients with TP [5]. Another study reported an even higher rupture rate of 86.61% in OP, markedly exceeding the 23% rupture rate previously documented in TP [9,14]. Hemodynamic shock has been reported in 30–71.4% of the OP cases [1]. These findings collectively suggest a worse prognosis for OP relative to TP. Additionally, some patients with EP, particularly those with a history of irregular menstrual cycles, may mistakenly attribute vaginal bleeding for menstruation, leading to the clinical sign of amenorrhea being overlooked. Therefore, clinicians should pay close attention to menstrual history.

Although the clinical manifestations of OP lack specificity, a combination of early quantitative serum β-hCG measurement, pelvic ultrasonography and LC can facilitate a preliminary diagnosis of OP. However, a definitive diagnosis requires surgical confirmation and histopathological examination of the resected tissue according to Spiegelberg's criteria: (1) the fallopian tube with its fimbria should be intact and separate from the ovary, (2) the gestational sac should occupy the normal position of the ovary, (3) the gestational sac should be connected to the uterus by the ovarian ligament, and (4) ovarian tissue must be present in the specimen attached to the gestational sac [15].

Although abnormally low and slowly increasing β-hCG levels can aid early detection of abnormal implantation, they are not specific to OP and hence cannot confirm the diagnosis [16]. Among the 16 OP patients in this study, one patient did not undergo serum β-hCG testing and instead had a urine hCG examination. Among the remaining 15 patients, 75% had serum β-hCG levels $\geq$1730.39 mIU/mL, and over 50% had serum β-hCG levels $\geq$4756.03 mIU/mL. It is considered that the relatively spacious location of the ovary and the tissue vascularization create favorable conditions for the growth of EP tissue. Some studies have reported that β-hCG levels tend to be higher in patients with OP than in those with TP [5,9,13]. In patients with high β-hCG levels but no visible gestational sac in the uterus or fallopian tubes, clinicians should maintain a high index of suspicion for OP.

Early ultrasound diagnosis facilitates appropriate treatment selection and monitoring, ultimately improving the clinical outcomes for patients with OP. The recommended ultrasound diagnostic criteria for OP include: (1) the presence of a wide echogenic ring on the surface of the ovary with an echo-transparent area inside; (2) ovarian cortex, CL or follicle around the mass; (3) The echo intensity of the ring is greater than that of the ovary itself [11]. However, differentiating ruptured OP from ruptured TP or CL hemorrhage using ultrasound remains challenging owing to overlapping sonographic features. In our study, all patients exhibited abnormal echoes or masses in the pelvic or adnexal regions on preoperative ultrasound. However, only one case revealed a gestational sac-like structure with fetal cardiac activity within the ovary, leading to the preoperative consideration of OP. One patient was diagnosed with ruptured CL hemorrhage using ultrasound, and the other's imaging findings were inconclusive between CL rupture and EP. The remaining 13 patients were suspected to have EP; however, the exact implantation site could not be clearly identified. Overall, the preoperative ultrasound diagnostic rate for OP in this series was only 6.25%. Preoperative ultrasound diagnosis of OP is often inaccurate, with the reported accuracy rates being as low as 2.5–18% [17–19]. This diagnostic uncertainty with ultrasound may lead to unnecessary damage or removal of the fallopian tubes, often due to false-negative diagnoses of OP or misdiagnoses as TP during LC. Huang et al. [7] reported a case of concurrent OP and TP following IVF-ET, highlighting the need for clinicians to maintain a high index of suspicion in patients with suspected EP, especially when significant intra-abdominal hemorrhage is present, and to consider the possibility of OP to prevent missed diagnoses.

Surgery remains the primary treatment for patients with OP. Advances in technology have led to LC becoming the standard approach for OP diagnosis and management. In our series of 16 patients with OP, 81.25% presented with ruptured OPs, and 50% had hemoperitoneum volume $\geq$900 mL. Despite these challenges, all patients were definitively diagnosed and treated laparoscopically, with favorable outcomes. LC offers enhanced local magnification, enabling a definitive diagnosis and precise surgical intervention with minimal trauma. Laparoscopic surgery for OP shares similar advantages with TP, including shorter hospital stays, faster patient recovery, and reduced postoperative adhesions. Minimally invasive surgery is now widely accepted and has proven successful, even in cases with significant hemoperitoneum, often making it preferable to laparotomy

[20,21]. However, laparotomy remains a viable option for patients who are comatose or in healthcare settings that lack access to advanced laparoscopic equipment or specialized expertise. Although OP is associated with higher intraoperative blood loss and an increased need for transfusion, mortality remains low in centers equipped with timely diagnostic and emergency surgical services [13].

The choice of the surgical technique for OP largely depends on the size and extent of the lesions. Options include removal of gestational products (RGP) from the ovary, ovarian wedge resection, or partial oophorectomy. Current surgical trends favor conservative approaches such as RGP or ovarian wedge resection [20], aiming to excise the intact gestational sac while preserving as much ovarian tissue and function as possible, which is particularly important for patients desiring future fertility. Resection of only the OP tissue itself is gaining acceptance, as it is considered the least invasive surgery that maximally preserves the ovarian cortex [22]. In our study, all patients with OP were managed conservatively with the goal of preserving ovarian function. Complete excision of the gestational sac was prioritized to prevent residual disease and avoid secondary treatments, such as methotrexate (MTX) or repeat surgery. During the procedure, meticulous resection of the gestational sac was performed with the assistance of bipolar cautery, followed by precise electrocoagulation hemostasis to minimize ovarian damage. For some patients, the ovarian wound surface was sutured to secure hemostasis, which allowed us to limit the use of electrocautery and thereby reduce thermal injury to the ovary. Other studies also recommend local injection of argipressin between normal ovarian tissue and the lesion, combined with ultrasound energy for hemostasis instead of electrocautery, have been used to preserve ovarian tissue [23]. Ovarian wedge resection may be necessary for larger or more advanced pregnancies. For patients in life-threatening situations, such as uncontrollable bleeding, oophorectomy remains a last-resort option. Previous studies reported oophorectomy rates of 14% and 21%, with blood transfusion rates ranging from 5% to 25% [6,13,24]. In our study, none of the patients underwent oophorectomy, and the blood transfusion rate was 12.50%. Considering that 16 patients in this study experienced OP during the first trimester and received timely intervention treatment, conditions were created for ovarian preservation. The average surgical duration and hospitalization period for the patients were within reasonable ranges. Histopathological examination confirmed OP in all 16 patients. Postoperative monitoring showed that the β-hCG levels returned to negative within 1 month. No patients required secondary MTX treatment or additional surgical treatment postoperatively. These results all reflect the safety and efficacy of the treatment.

Limitations

OP is rare and the number of patients with OP in the present was limited. Large sample and multicenter research is required to further investigation. One case had a missing preoperative serum β-hCG outcome, which is a limitation of retrospective studies. In addition, due to the lack of long-term follow-up data, our findings do not allow for an analysis of ovarian function and pregnancy outcomes after surgery, which needs further study.

5. Conclusions

Based on nearly a decade of research on OP, we have summarized some diagnostic and treatment experiences for OP. This study underscores the importance of recognizing the risk factors and key clinical features of OP, as well as understanding the limitations of ultrasound in its diagnosis. Patients with OP tend to experience more severe clinical outcomes. LC offers a superior option for both the diagnosis and treatment of OP, providing precise visualization with minimal invasiveness, even in cases of heavy pelvic and abdominal bleeding.

Abbreviations

OP, ovarian pregnancy; EP, ectopic pregnancy; TP, tubal pregnancy; CL, corpus luteum; BMI, body mass index; β-hCG, beta human chorionic gonadotropin; TVS, transvaginal ultrasound; TAS, transabdominal ultrasound; LC, laparoscopy; RGP, removal of gestational products; IVF-ET, *in vitro* fertilization-embryo transfer; IUD, intrauterine device; MTX, methotrexate; SA, spontaneous abortion; IA, induced abortion; N, number of cases; EGS, ectopic gestational sac; R, right; L, left.

Availability of Data and Materials

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

Author Contributions

(I) Conception and design: LX; (II) Administrative support: JQ; (III) Collection of data: LX and TQ; (IV) Analysis of data: LX, TQ, LC and JQ. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was carried out in accordance with the guidelines of the Declaration of Helsinki, and was approved by the Ethics Committee of the Institutional Review Board of the First Affiliated Hospital, Zhejiang University School of Medicine ([2025B] IIT Ethics Approval No. 0976). A written consent was signed by the patients or their families/legal guardia.

Acknowledgment

Conflict of Interest

The authors declare no conflict of interest.

Declaration of AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT-3.5 in order to check spelling and grammar. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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