Clinical and Experimental Obstetrics & Gynecology

Clin. Exp. Obstet. Gynecol. **2024**; 51(10): 226
https://doi.org/10.31083/j.ceog5110226

Original Research

Factors Influencing Postoperative Recurrence and Live Birth Achievement after Laparoscopic Surgery for Ovarian Endometrioma: A Retrospective Study in a Regional Core Hospital

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Academic Editor: Michael H. Dahan
Submitted: 22 May 2024 Revised: 10 July 2024 Accepted: 31 July 2024 Published: 10 October 2024

Abstract

Background: Ovarian endometrioma (OMA) is a common gynecological condition affecting women of reproductive age, often requiring laparoscopic surgery for removal. However, the management of OMA, including postoperative hormone therapy, is complex and must be tailored to the individual's conditions. Therefore, to provide meaningful insights, we aimed to analyze 10 years of accumulated data from patients who underwent laparoscopic surgery for OMA, with a primary focus mainly on postoperative OMA recurrence and live birth outcomes. **Methods**: We reviewed the medical records of 158 patients who underwent laparoscopic surgery for OMA, including total laparoscopic cystectomy (TLC) (79 patients), total laparoscopic adnexectomy (TLA) (62 patients), or both unilateral TLA and contralateral TLC (17 patients), between January 2014 and December 2023. Among the OMA patients, we identified 7 cases of postoperative OMA recurrence out of 158 patients, and 23 live births among 79 TLC patients. We performed a multivariate logistic regression analysis to assess the impact of each representative factor on postoperative OMA recurrence and live birth achievement. **Results**: The multivariate analyses of the 158 patients revealed that advance age and massive blood loss were significantly associated with an increased risk of postoperative OMA recurrence, while postoperative hormone treatment was associated with a decreased risk of recurrence. In the analysis of live birth achievement among the 79 TLC patients, advanced age, postoperative hormone treatment and cancer antigen 125 (CA125) positivity were significantly associated with a reduced likelihood of achieving live birth. **Conclusions**: Our data highlight the unfavorable effects of advanced age, massive blood loss and CA125 positivity on the outcomes of laparoscopic surgery for OMA. Additionally, postoperative hormone treatment was found to decrease postoperative OMA recurrence. These findings may offer more accurate information to guidance in selecting treatment options for patients with OMA.

Keywords: ovarian endometrioma; postoperative ovarian endometrioma recurrence; live birth achievement; retrospective study; advanced age; massive blood loss; CA125 positivity; postoperative hormone treatment; total laparoscopic cystectomy; total laparoscopic adnexectomy

1. Introduction

Endometriosis is one of the most common gynecological diseases, affecting approximately 5% of women of reproductive age. It most frequently involves the ovaries, leading to the formation of a cystic mass known as an ovarian endometrioma (OMA) [1,2]. OMA can be relatively easily to diagnosed using transvaginal ultrasound (TVUS) and magnetic resonance imaging (MRI), but its treatments is complex. Among them, laparoscopic surgeries are commonly performed to improve pain symptoms and fertility [3–6]. However, postoperative management is often needed for patients who do not wish to conceive immediately after surgery, as there is a relatively high risk of postoperative recurrence [2,7,8]. In one previous review, the recurrence rate has been reported to exceed 20% five years after treatment [5]. Postoperative management includes hormonal treatments, including dienogest, oral contraceptive pills (OCPs), and gonadotropin-releasing hormone (GnRH) analogues. Comprehensive management, including careful postsurgical follow-up, is essential, with the choice of treatment tailored to the individual patient's situation and risk factors, such as age, parity, OMA cyst size, and American Society for Reproductive Medicine score (ASRM score). In particular, for patients with infertility, the timing of laparoscopic surgeries and postoperative management become more complex, as hormonal treatments can hinder pregnancy during the postoperative period [4–6]. For this reason, we have prioritize postoperative recurrence and live birth outcomes in our treatment to selection, aiming to improve quality of life for our patients. We have leveraged our hospital's unique advantage as the sole perinatal medical center in a rural area to achieve this goal. Therefore, in this study, we analyzed 10 years of accumulated data from patients who underwent laparoscopic surgery for OMA. Our aim was to identify significant factors associated with both favorable outcomes, such as live birth achievement, and unfavorable outcomes, such as recurrence.

2. Materials and Methods

2.1 Data Collection

This retrospective case series study was reviewed and approved by the Human Ethical Committee of Kinan Hospital (Approval Number: 283, Clinical Outcomes of Endoscopic Surgery: Retrospective Analyses, 2024/4/23). The study was conducted from January 2014 to December 2023. Informed consent was obtained from each patient prior to their inclusion in the study. The deidentified medical records of 158 female patients aged 50 years or younger, who underwent laparoscopic surgery for the treatment of OMA confirmed by TVUS and/or MRI prior to surgery, were reviewed retrospectively. Among these 158 patients, the surgical approaches used were total laparoscopic cystectomy (TLC) (79 patients), total laparoscopic adnexectomy (TLA) (62 patients), and a combination of unilateral TLA and contralateral TLC (17 patients). Bilateral OMA was detected in 28 patients in the TLC group, 10 patients in the TLA group, and 17 patients in the combined TLA and TLC groups. Concomitant laparoscopic myomectomy (LM) was performed in 8 patients. A total of 5 patients were excluded from the study due to recurrent OMA (3 patients) and postoperative detection of breast cancer (2 patients). Since the analysis was restricted to patients of reproductive age (those younger than 50 years) and excluded those who underwent both abdominal and laparoscopic hysterectomy, the number of patients excluded from the study was small.

We extracted data on representative patient characteristics, such as age, delivery history, physical data, and presenting symptoms, from medical records. The follow-up period was calculated by subtracting the operation date of surgery from the last outpatient visit, postoperative hormone treatment included dienogest (61 patients), OCPs (37 patients), GnRH analogues (5 patients), and levonorgestrel-releasing intrauterine devices (2 patients). In 15 patients, multiple hormone treatment methods were used in combination.

2.2 Analysis Method

First, all 158 patients were divided into two groups according to the presence or absence of postoperative OMA recurrence. The 15 indicators listed in Table 1 were then compared via Student's *t*-test and Pearson's Chi-square test. Similarly, the 79 patients who underwent TLC were divided into two groups based on whether a live birth was achieved. The 12 indicators listed in Table 2 were then compared.

Next, to identify risk factors for postoperative OMA recurrence, we performed a multivariate logistic regression analysis. Patients were divided into two groups according to the presence or absence of the following factors: (1) advanced age, defined as $\geq$35 years; (2) high American Society for Reproductive Medicine score (ASRM score), defined as a score $\geq$80; (3) large cyst, defined as a cyst measuring $\geq$80 mm; (4) elevated body mass index (BMI), defined as BMI $\geq$22 kg/m^2; (5) nulliparity, defined as no previous deliveries; (6) postoperative hormone treatment; (7) bilateral cysts; (8) TLA; (9) cancer antigen 125 (CA125) positivity, defined as a serum CA125 level $\geq$35 U/mL; (10) long operation time, defined as an operation time $\geq$150 minutes; and (11) massive blood loss, defined as a blood loss amount $\geq$200 mL (see Table 3). Similarly, to identify the factors influencing live birth achievement, we analyzed the aforementioned 10 factors after excluding TLA (Table 4). The criteria for "large cyst", "long operation time", and "massive blood loss" were determined based on of the average (Avg) and standard deviation (SD) (minimum (Min) and maximum (Max)) of the aforementioned 158 and 79 patients.

Statistical analyses were performed using Microsoft Excel 365 (Microsoft Corporation, Redmond, WA, USA) and JMP version 17 for MAC (SAS Institute, Inc., Tokyo, Japan) to determine the correlations between patient characteristics and the outcomes of laparoscopic surgery. The odds ratios (ORs) and 95% confidence intervals (95% CIs) were estimated to determine the strength of the correlations. $p < 0.05$ indicated statistical significance.

3. Results

3.1 Patient Characteristics

The results obtained (Avg $\pm$ SD [Min–Max]) of the follow-up time, age, BMI, cyst size, and ASRM were 1304.6 $\pm$ 1094.3 (25–3731) days, 36.7 $\pm$ 7.2 (21–50) years, 21.6 $\pm$ 3.8 (14.5–35.1) kg/m^2, 62.1 $\pm$ 22.2 (14–146) mm, and 54.0 $\pm$ 32.1 (17–144), respectively (Table 1). Almost all patients (144/158 patients) experienced menstruation-related symptoms, including pain (122 patients) or hypermenorrhea (120 patients). However, data on infertility were not available. In these cases, presenting symptoms were excluded from the analyses. When comparing the postoperative OMA recurrence group with the control group, a significant difference was found only in the follow-up time, probably due to the small number of patients with postoperative OMA recurrence. On the other hand, as shown in Table 2, the analysis of live birth achievement revealed significantly lower values for age, cyst size, and postoperative hormone treatment.

3.2 Risk Factors for Postoperative OMA Recurrence

Postoperative OMA recurrence was detected in 7 of 158 patients, with all diagnoses confirmed via MRI. The recurrence rate observed in this study was relatively low. This was probably due to the presence of patients who were referred to our hospital specifically for TLC or TLA. In these patients, the follow-up period was inevitably short. Additionally, only approximately 40% of patients underwent TLA (n = 62/158), and OMA recurrence was detected in 1 patient.

Table 1. Characteristics of patients who experienced postoperative OMA recurrence.

	Total (Avg. ± SD, Min–Max, Number)	Postoperative OMA recurrence cases (Avg. ± SD, Min–Max, Number)	Control (Avg. ± SD, Min–Max, Number)	*p*-value
Follow-up period (days)	1304.6 ± 1094.3, 25–3731, n = 158	2831.3 ± 991.7, 1585–3731, n = 7	1233.8 ± 1048.9, 25–3674, n = 151	<0.01
Age (years)	36.7 ± 7.2, 21–50, n = 158	38.1 ± 5, 33–45, n = 7	36.6 ± 7.3, 21–50, n = 151	0.58
BMI (kg/m^2)	21.6 ± 3.8, 14.5–35.1, n = 154	20.6 ± 2.4, 17.9–24.5, n = 7	21.7 ± 3.8, 14.5–35.1, n = 147	0.45
Cyst size (mm)	62.1 ± 22.2, 14–146, n = 158	61.9 ± 27.3, 20–109, n = 7	62.1 ± 22.1, 14–146, n = 151	0.97
ASRM score	54.0 ± 32.1, 17–144, n = 158	64.1 ± 23.6, 33–92, n = 7	53.5 ± 32.4, 17–144, n = 151	0.39
Operation time (minutes)	115.5 ± 41.8, 43–262, n = 158	140.1 ± 44.1, 84–208, n = 7	114.4 ± 41.5, 43–262, n = 151	0.11
Blood loss amount (mL)	49.7 ± 91.5, 0–507, n = 158	80.4 ± 123.5, 0–306, n = 7	48.3 ± 90, 0–507, n = 151	0.36
Nulliparity	n = 94/158	n = 4/7	n = 90/151	1.00
Postoperative hormone treatment	n = 89/158	n = 2/7	n = 87/151	0.51
Bilateral cysts	n = 55/158	n = 3/7	n = 52/151	0.98
CA125 positivity	n = 101/158	n = 5/7	n = 96/151	0.98
TLC	n = 79/158	n = 5/7	n = 74/151	0.72
TLA	n = 62/158	n = 1/7	n = 61/151	0.59
Unilateral TLA and contralateral TLC	n = 17/158	n = 1/7	n = 16/151	0.99
Concomitant LM	n = 8/158	n = 1/7	n = 7/151	0.73

158 patients were divided into two groups according to the presence or absence of postoperative OMA recurrence, and 15 representative indices were compared.

Avg, average; ASMR score, American Society for Reproductive Medicine score; BMI, body mass index; CA125, cancer antigen 125; LM, laparoscopic myomectomy; Max, maximum; Min; minimum; OMA, ovarian endometrioma; SD, standard deviation; TLA, total laparoscopic adnexectomy; TLC, total laparoscopic cystectomy.

Table 2. Characteristics of patients who achieved a live birth.

	Total (Avg. ± SD, Min–Max, Number)	Live birth achievement cases (Avg. ± SD, Min–Max, Number)	Control (Avg. ± SD, Min–Max, Number)	*p*-value
Follow-up period (days)	1301.2 ± 1081.6, 25–3731, n = 79	1652 ± 1134.2, 208–3674, n = 23	1157.1 ± 1035.4, 25–3731, n = 56	0.06
Age (years)	31.5 ± 5.2, 21–45, n = 79	29.6 ± 4, 22–35, n = 23	32.3 ± 5.5, 21–45, n = 56	0.03
BMI (kg/m^2)	21.9 ± 3.8, 15.7–33.3, n = 79	23.0 ± 4.8, 15.7–33.3, n = 23	21.5 ± 3.3, 16.6–32.0, n = 56	0.11
Cyst size (mm)	61.7 ± 20.6, 14–146, n = 79	48.7 ± 17.1, 20–90, n = 23	67.1 ± 19.6, 14–146, n = 56	<0.01
ASRM score	51.2 ± 28.9, 17–128, n = 79	45.5 ± 24.2, 17–108, n = 23	53.6 ± 30.6, 20–128, n = 56	0.26
Operation time (minutes)	124.2 ± 41, 58–221, n = 79	118.3 ± 41.9, 58–208, n = 23	126.7 ± 40.8, 62–221, n = 56	0.41
Blood loss amount (mL)	59.6 ± 105.9, 0–507, n = 79	41.1 ± 96.8, 0–350, n = 23	67.2 ± 109.4, 0–507, n = 56	0.32
Nulliparity	n = 63/79	n = 21/23	n = 42/56	0.44
Postoperative hormone treatment	n = 46/79	n = 6/23	n = 40/56	<0.01
Bilateral cysts	n = 28/79	n = 5/23	n = 23/56	0.45
CA125 positivity	n = 21/79	n = 6/23	n = 15/56	1.00
Concomitant LM	n = 2/79	n = 1/23	n = 1/56	0.93

79 patients were divided into two groups according to whether a live birth was achieved, and 12 representative indices were compared.

Avg, average; ASMR score, American Society for Reproductive Medicine score; BMI, body mass index; CA125, Cancer Antigen 125; LM, laparoscopic myomectomy; Max, maximum; Min; minimum; SD, standard deviation.

Table 3. Risk factors for postoperative OMA recurrence.

Factors	OR (95% CI, Number)	*p*-value
Advanced age ≥35 years old	4.1 (0.5–34.6, n = 6/96)	<0.01
High ASRM score ≥80	2.6 (0.6–12.1, n = 3/37)	0.57
Large cyst ≥80 mm	0.9 (0.1–7.7, n = 1/25)	0.47
Above standard BMI ≥22 kg/m^2	0.8 (0.2–4.3, n = 2/52)	0.80
Nulliparity	0.9 (0.2–4.2, n = 4/94)	0.77
Postoperative hormone treatment	0.3 (0.1–1.6, n = 2/89)	0.03
Bilateral cysts	1.4 (0.3–6.6, n = 3/55)	0.27
TLA	0.2 (0.0–2.1, n = 1/62)	<0.01
CA125 positivity	1.4 (0.3–7.6, n = 5/101)	0.48
Long operation time ≥150 minutes	1.8 (0.3–9.5, n = 2/30)	0.78
Massive blood loss ≥200 mL	3.9 (0.7–22.1, n = 2/16)	0.03

Multivariate analysis was performed on 158 patients to examine the effects of 11 representative factors based on data collected from medical records. Table shows the number of patients with each factor, the ORs and 95% CIs for postoperative OMA recurrence, and the *p*-values.

ASMR score, American Society for Reproductive Medicine score; BMI, body mass index; CA125, cancer antigen 125; CI, confidence interval; OMA, ovarian endometrioma; OR, odds ratio; TLA, total laparoscopic adnexectomy.

To identify significant factors affecting the likelihood of postoperative OMA recurrence while controlling for confounding factors, a multivariate analysis of 11 representative factors was performed (Table 3). This analysis revealed that advanced age (OR: 4.1, $p < 0.01$) and massive blood loss (OR: 3.9, $p < 0.05$) were significant factors that increased the likelihood of postoperative OMA recurrence. Conversely, postoperative OMA recurrence was significantly and negatively associated with postoperative hormone treatment (OR: 0.3, $p < 0.05$) and TLA (OR: 0.2, $p < 0.01$).

3.3 Factors Influencing Live Birth

In total, 24 out of 158 patients achieved a live birth, including 23 out of 79 patients who underwent TLC. Next, data from 79 patients who underwent TLC and were aged between 21 and 45 years old were analyzed via multivariate analysis of 10 representative factors to identify significant factors affecting the likelihood of achieving a live birth (Table 4). The present analysis revealed that three factors, namely, advanced age (OR: 0.4, $p < 0.05$), postoperative hormone treatment (OR: 0.1, $p < 0.01$), and CA125 positivity (OR: 0.3, $p < 0.05$), had significant negative effects on live birth achievement.

4. Discussion

Laparoscopic surgery has become a commonly performed procedure for the treatment of OMA due to its relatively short recovery time, brief hospital stay, and minimal surgical wound [3]. However, managing OMA after surgery is complex due to its relatively high recurrence rate.

Table 4. Factors influencing live birth achievement.

Factors	OR (95% CI, Number)	*p*-value
Advanced age ≥35 years old	0.4 (0.1–1.4, n = 4/23)	0.02
High ASRM score ≥80	0.8 (0.2–2.7, n = 4/16)	0.72
Large cyst ≥80 mm	0.2 (0.0–1.5, n = 1/12)	0.19
Above standard BMI ≥22 kg/m^2	1.7 (0.6–4.4, n = 11/31)	0.08
Nulliparity	3.5 (0.7–16.8, n = 21/63)	0.09
Postoperative hormone treatment	0.1 (0.0–0.4, n = 6/46)	<0.01
Bilateral cysts	0.4 (0.1–1.2, n = 5/28)	0.28
CA125 positivity	0.3 (0.1–0.7, n = 9/49)	0.02
Long operation time ≥150 minutes	1.0 (0.3–2.9, n = 6/21)	0.75
Massive blood loss ≥200 mL	0.6 (0.1–2.9, n = 2/10)	0.80

Multivariate analysis was performed on the data of 79 patients to examine the effects of 11 representative factors for which data were collected from medical records. Table shows the number of patients with each factor, the ORs and 95% CIs for live birth achievement, and the *p*-values.

ASMR score, American Society for Reproductive Medicine score; BMI, body mass index; CA125, cancer antigen 125; CI, confidence interval; OR, odds ratio.

Therefore, postoperative follow-up, including postoperative hormone treatment, is crucial [2,9]. In particular, when performing TLC to preserve fertility, complete removal of the endometriotic lesion is often not feasible. In this analysis, TLA was found to have a significant negative impact on postoperative OMA recurrence. To improve OMA treatment and inform the selection of appropriate management strategies, whether expectant, medical, or surgical management [10], comprehensive analyses of patient data, including surgical outcomes and follow-up durations, are becoming increasingly important. Therefore, in this study, since more than 70% of patients (n = 115/158) were followed up after surgery for over 1 year, we collected data on both good and unfavorable outcomes, specifically, live birth achievement and recurrence.

In evaluating postoperative OMA recurrence as an unfavorable result, we found that three factors—advanced age, massive blood loss, and postoperative hormone treatment—were significant. As expected, postoperative hormone treatment proved effective in decreasing endometriosis recurrence [2,9]. Among the aforementioned 115 patients who were followed up for over 1 year, more than 65% (n = 75/115) received postoperative hormone treatment. This tendency might have contributed to the relatively low recurrence rate observed in our study, consistent with findings reported in previous reports [11]. The other two factors may indicate advanced endometriosis and increased surgical difficulty. Advanced age also had a significant negative impact on likelihood of achieving of a live birth. In this study, we were unable to identify any cases where nulliparous women aged 36 years or older delivered a baby after laparoscopic surgery. The negative impact of CA125 positivity may indicate the presence of undetectable endometriosis, while the negative of postoperative hormone treatment could be attributed to its to suppression of ovulation. In contrast to previous reports [2,12], we did not find a significant effect of cyst size or the ASRM score. Additionally, to validate our findings regarding significant factors, additional data and analyses may be required. Unfortunately, this study had several limitations due to its retrospective nature and the fact that it was conducted at a rural general hospital. Specifically, the data were not always sufficient, particularly regarding presenting symptoms. Additionally, there was variability in follow-up periods, and the number of variables for which data were extracted was limited. To address these limitations, data analysis at hospitals with advanced capabilities, such as university hospitals, may be necessary. The management methods, including surgical techniques and postoperative infertility treatments, were also limited by physician skill and institutional capacity. In rural hospitals, introducing new techniques, such as laser vaporization [13], laparoscopic ovarian suturing [14,15], and assisted reproductive technologies, can be challenging. Therefore, further large-scale studies are needed to obtain more accurate and comprehensive information.

5. Conclusions

We identified the factors that negatively impact the outcomes of laparoscopic surgery for OMA, including advanced age, massive blood loss, and CA125 positivity. Additionally, postoperative hormone treatment was associated with a reduction in postoperative OMA recurrence. These results offer valuable insights to guide the selection of treatment methods for OMA. However, due to limitations associated with using retrospective data from medical records, further studies are needed.

Abbreviations

ASRM score, American Society for Reproductive Medicine score; Avg, average; BMI, body mass index; CA125, cancer antigen 125; GnRH, gonadotropin-releasing hormone; LM, laparoscopic myomectomy; MRI, magnetic resonance imaging; CI, confidence interval; OCP, oral contraceptive pill; OMA, ovarian endometrioma; OR, odds ratio; SD, standard deviation; TLA, total laparoscopic adnexectomy; TLC, total laparoscopic cystectomy; TVUS, transvaginal ultrasound.

Availability of Data and Materials

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

Author Contributions

RA and WI collected and analysed the data and wrote the manuscript. WI supervised the entire study. SH, RA, WI, HF, JT and AM performed medical care on the subjects. SH determined the surgical method and supervised all medical procedures. All the authors have read and approved the final manuscript. All authors contributed to editorial changes in the 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

This study was reviewed and approved by the Human Ethical Committee of Kinan Hospital (approval number 283). Informed consent was obtained from all patients.

Acknowledgment

This research was supported by Kina Hospital regarding the provision of medical information.

Funding

The authors disclose the receipt of financial support from the Wakayama Prefecture Obstetrician Secure Fund for the preparation and publication of this article.

Conflict of Interest

The authors declare no conflict of interest.

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