

Original Article



Oncological safety of minimally invasive surgery in borderline ovarian tumor and ovarian cancer: a retrospective comparative study

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ABSTRACT

Objective: This study aimed to evaluate the oncological safety of laparoscopic surgery for patients with benign tumors who underwent laparoscopic surgery at our facility and were subsequently diagnosed with borderline ovarian tumors or ovarian cancer.

Methods: We conducted a retrospective review of 45 patients initially diagnosed with benign ovarian tumors who underwent laparoscopic surgery at our institution from January 2009 to April 2024.

Results: Postoperative pathological examination identified 32 cases of borderline ovarian tumors and 13 cases of ovarian cancer. Laparoscopic cystectomy was performed in 14 (43.8%) borderline cases and 4 (30.8%) ovarian cancer cases. Out of 14 patients with borderline ovarian tumors who underwent cystectomy, 8 subsequently underwent staging laparotomy, whereas 6 underwent only ovarian tumor cystectomy. In contrast, none of the patients with ovarian cancer completed treatment with only ovarian tumor cystectomy. Recurrent disease was observed in 9.4% of borderline tumor cases, all of which were successfully managed with further surgery. In the ovarian cancer group, recurrence occurred in 31% of patients, with 3 resulting in tumor-related mortality.

Conclusion: Laparoscopic surgery for borderline ovarian tumors is suggested to be oncologically safe, with low recurrence rate and no adverse impact on survival. However, for ovarian cancer, particularly in cases with peritoneal dissemination, rapid disease progression remains a concern. While this study suggests that laparoscopic surgery may be a viable option for borderline ovarian tumors, further research is needed to validate these findings, particularly for ovarian cancer.

Keywords: Ovarian Neoplasms; Surgery; Laparoscopy

INTRODUCTION

Surgical management of ovarian tumors primarily involves laparotomy—a highly invasive procedure that commonly results in complications such as ileus and infections [1-3]. Although reports are limited in Japan, there has been a global increase in reports on

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Author Contributions

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minimally invasive surgery performed for borderline ovarian tumors and ovarian cancer, indicating that the rates are equivalent to or better than those of laparotomy, with increasing evidence of oncological safety [4-9]. However, the evidence remains limited with only a few prospective studies. In Japan, laparoscopic surgery for borderline ovarian tumors and ovarian cancer is not covered by insurance [3]. Furthermore, the available verifiable data in Japan are confined to the prognosis of patients who underwent laparoscopic surgery with a preoperative diagnosis of benign tumors but were postoperatively diagnosed with borderline ovarian tumors or ovarian cancer. Many reports on laparoscopic surgery for borderline ovarian tumors and ovarian cancer are sporadic case collections, case-control studies, or systematic reviews. However, high-quality evidence regarding the efficacy of laparoscopic procedures is lacking. The accumulation of such data is crucial for the design of future prospective studies. Therefore, this study aimed to demonstrate the efficacy of laparoscopic procedures by analyzing the clinical outcomes of patients treated at our institution for borderline ovarian tumors and ovarian cancer initially diagnosed as benign and treated with laparoscopic surgery, but later diagnosed as borderline ovarian tumors and ovarian cancer.

MATERIALS AND METHODS

This retrospective study was approved by our Institutional Review Board of Jichi Medical University, Saitama Medical Center (S24-014), and informed consent was waived because of its retrospective nature. The inclusion criteria were as follows: patients over 20 years old and patients initially diagnosed with benign tumors who underwent laparoscopic surgery at our facility from January 2009 to April 2024 and were subsequently found to have borderline ovarian tumors or ovarian cancer. All histological subtypes were eligible for inclusion. Patients with a history of other malignancies were excluded from this study.

Comprehensive diagnoses were made using imaging techniques, such as ultrasonography and magnetic resonance imaging, along with tumor marker analysis. Laparoscopic surgery was performed in patients in whom malignancy was not strongly suspected based on these preliminary assessments.

The surgical procedures included either ovarian cystectomy or salpingo-oophorectomy, and all surgeries were performed under general anesthesia. Initial abdominal access was obtained via the umbilicus using the open Hasson technique. Additional trocars were strategically placed bilaterally beside the rectus abdominis muscles, 1–2 cm above the anterior superior iliac spine and between the umbilicus and pubis. In cases of laparoscopically assisted surgery, a small incision of 5–8 cm in width was made 2 horizontal finger breadths above the pubic symphysis. The pneumoperitoneum was maintained with low-pressure CO₂ (8 mmHg).

Patient age, tumor size, parity, and surgical procedures were examined. In addition, reoperations performed following the postoperative diagnosis (if any), the presence of tumor recurrence or mortality, and the location of any recurrence were investigated. Statistical analyses were performed using IBM SPSS for Windows version 26 (IBM Corp., Armonk, NY, USA). The statistical methods included the Mann–Whitney U test and Fisher's exact test, with a p-value of <0.05 considered statistically significant.

RESULTS

We identified 45 patients who met the inclusion criteria. **Table 1** presents the patient characteristics. Among 45 patients who underwent laparoscopic surgery with a preoperative diagnosis of benign ovarian tumors, postoperative pathological examination revealed borderline ovarian tumor and ovarian cancer in 32 and 13 patients, respectively. The median follow-up period was 32 months. Patients with borderline ovarian tumors were significantly younger than those with ovarian cancer. There were no significant differences in tumor size, parity, or number of ovarian tumor cystectomies performed between these 2 groups. Out of 14 patients with borderline ovarian tumors who underwent cystectomy, 8 subsequently underwent staging laparotomy, whereas 6 underwent only ovarian tumor cystectomy. In contrast, none of the 4 patients with ovarian cancer completed treatment with only ovarian tumor cystectomy; they were all subsequently treated with staging laparotomy. Among 7 patients with ovarian cancer who did not undergo staging laparotomy, 4 patients underwent total hysterectomy and bilateral salpingo-oophorectomy during the initial surgery, whereas the remaining 3 patients underwent laparoscopic unilateral salpingo-oophorectomy. These patients did not wish to undergo additional staging laparotomy, even though we fully recommended its importance.

Three patients (9.4%) with borderline ovarian tumors experienced recurrence: one was ipsilateral after cystectomy, and 2 were contralateral after unilateral salpingo-oophorectomy. All recurrences were completely resected during subsequent surgeries, after which no further recurrences were observed. Four patients (31%) with ovarian cancer experienced recurrence: one patient exhibited no recurrence after secondary debulking surgery, and 3 patients died due to tumor-related mortality. All the 4 patients had undergone subsequent staging laparotomy after laparoscopic surgery. The histological types of tumors that resulted in death were clear cell carcinoma in one case and squamous cell carcinoma in 2 cases. All patients initially presented with only pelvic dissemination during the initial laparoscopic surgery and were suspected to be at stage IIB or more ovarian cancer. However, the patients were given a preoperative explanation for benign surgery only, but not for open transfer and staging laparotomy for ovarian cancer. Therefore, the scheduled benign ovarian procedure and pelvic dissemination sampling were performed, after which staging laparotomy was performed following the diagnosis of ovarian cancer on a permanent specimen. Patients progressed to extensive intra-abdominal dissemination at the time of staging laparotomy, indicating rapid disease progression within a short period, and final diagnosis was stage IIIC. The 2 cases of squamous cell carcinoma had a rapid clinical course, with an overall survival of <11 months. The remaining patients with malignant tumors included 6 cases at stage IC and 3 at stage IA, with no recurrence observed in any of these patients.

Table 1. Patient characteristics

Characteristics	Borderline ovarian tumor (n=32)	Ovarian cancer (n=13)	p-value
Age (yr)	18–69 (32)	23–65 (49)	0.016
Tumor size (mm)	53–318 (84.5)	24–170 (66)	0.098
Nulliparous	19 (59.4)	9 (69.2)	0.737
Cystectomy	14 (43.8)	4 (30.8)	0.514
Staging laparotomy after laparoscopic surgery	8 (25.0)	6 (46.2)	0.151

Values are presented as range (median) or number (%).

DISCUSSION

This retrospective analysis investigated patients initially diagnosed with benign ovarian tumors who underwent laparoscopic surgery and were later diagnosed with borderline ovarian tumors or ovarian cancer. Laparoscopic surgery was suggested to be oncologically safe for patients with borderline ovarian tumors, even when diagnosed postoperatively, with recurrences limited to the ovaries and no impact on overall survival prognosis. Although the number of ovarian cancer cases was small, cases with peritoneal dissemination that resulted in incomplete surgery could potentially worsen over a short period.

Borderline ovarian tumors are associated with relatively favorable prognoses [10] and can be treated laparoscopically. The high survival rate and promising long-term prognosis have led to international guidelines recommending laparoscopic surgery in certain cases [11]. Previous studies reported no difference in prognosis between laparoscopic and open surgery [4-6,12-17] and showed that overall survival was not compromised even with additional resection in cases of recurrence [18-20], thereby demonstrating the safety of laparoscopic surgery. However, there is a higher risk of intraoperative capsular rupture during laparoscopic surgery, raising concerns about the intra-abdominal dissemination of tumor cells. Although intraoperative rupture in surgeries, such as fertility-sparing surgery, does not affect recurrence or overall survival rates [21,22], capsular rupture should be minimized as much as possible when malignancy cannot be completely ruled out.

The collection of treatment outcomes for early ovarian cancer with laparoscopic surgery is an ongoing effort, with an increasing number of reports indicating the safety and preservation of oncological prognoses. A Cochrane review that compared laparoscopic and open surgery reported no difference in the number of lymph node dissections or weight of the omentum resected, noted that surgery time depends on the institution rather than the surgical method, and found that laparoscopic surgery has fewer perioperative complications but a higher rate of intraoperative ruptures [23]. Additionally, prognostic reports indicate that overall survival rates are equivalent between laparoscopic and open surgeries [7-9], and recurrence rates are either lower [8] or the same [7,9] with laparoscopic surgery. As intraoperative capsular rupture results in upstaging, it is considered sufficiently safe if performed by a well-trained team with appropriate patient selection [24]. As long-term prognostic studies are insufficient, further studies are necessary.

A strong point of this study is that in Japan, the number of reports on the efficacy of laparoscopic surgery for borderline ovarian tumors and ovarian cancer is small [25]. In our study, a substantial number of cases were accumulated, particularly for borderline ovarian tumors, demonstrating the safety of the procedure. In cases where young patients strongly desired fertility preservation, laparoscopic tumor resection was performed during the first surgery, after which the staging surgery was performed, and oncological safety was suggested to be maintained by subsequent adnexectomy.

Owing to the retrospective nature of this study, there were limitations to the analysis. As opposed to the considerable number of borderline ovarian tumor cases, the number of ovarian cancer cases was small, possibly leading to insufficient examination. All the surgeries performed were either laparoscopic cystectomy or oophorectomy based on preoperative diagnosis of benign ovarian tumor, which was later diagnosed as borderline tumor or ovarian cancer. Since we did not perform complete staging laparotomy for ovarian cancer in the

first laparoscopic surgery, we cannot conclude whether laparoscopic surgery is completely safe. Laparoscopic surgery for malignant tumor is different from that for benign tumor, because care is needed to prevent cancer cell spillage and intraoperative capsular rupture. The available literature discussed above mainly focuses on first staging laparoscopic surgery for assessing the malignancy of ovarian tumor. Of note, complete staging laparotomy for ovarian cancer should be performed, not hysterectomy and bilateral oophorectomy and omentectomy only. To bridge this gap, it is necessary to conduct a prospective clinical trial and multicenter retrospective studies. Given the high number of older patients with ovarian cancer in Japan, women's frailty and performance status should be considered when making treatment decisions, as these factors are associated with a high risk of short overall survival, requirement for intensive care, non-routine discharge, death during hospitalization, and need for readmission [26]. Adequately planned minimally invasive surgery and combined molecular targeted therapy may have a positive impact on survival outcomes in future.

In conclusion, this study suggests the potential of laparoscopic surgery for the treatment of borderline ovarian tumors. Given the few ovarian cancer cases, the oncological safety of laparoscopic surgery could not be conclusively determined in this study. The present study was limited to a single facility, and thus we aim to accumulate further evidence through collaborative studies with multiple facilities.

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