Original Article

Management of Large Ovarian Tumors in Elderly Patients Using the Aron Alpha Method and Principles of Enhanced Recovery after Surgery

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Abstract

Objectives: We performed preoperative evaluations of giant ovarian tumors in older adult patients using the comprehensive geriatric assessment (CGA) and estimation of physiologic ability and surgical stress (E-PASS) scoring systems. We report a case in which the Aron Alpha method was performed, and perioperative management was performed using enhanced recovery after surgery (ERAS).

Materials and Methods: We performed preoperative evaluations using the E-PASS scoring system and CGA on older adult patients with giant ovarian tumors, followed by the minimally invasive Aron Alpha method and perioperative management using ERAS.

Results: The mean patient age was 75.8 ± 8.8 years; comorbidities included hypertension in three patients, hyperlipidemia in two, angina pectoris in one, cholecystitis in one, and lower extremity varicose veins in one. The mean tumor size was 21.0 ± 5.4 cm. The E-PASS scoring system showed a preoperative risk score of 0.7 ± 0.4, a surgical stress score of 0, and a comprehensive risk score of 0.3 ± 0.3. CGA showed that two patients had problems with activities of daily living and cognitive function. The mean duration of surgery was 89.0 ± 16.6 min, and the mean blood loss was 56.0 ± 65.4 mL. No surgery-associated complications were observed. No patients had prolonged hospitalization or a decline in activities of daily living.

Conclusion: We showed the usefulness of performing detailed preoperative evaluations using CGA and the E-PASS system, followed by the minimally invasive Aron Alpha surgical method and perioperative management using ERAS in improving surgical outcomes in older adult patients with giant ovarian tumors.

Keywords: Ascites cytology, cystadenoma, cystic, laparoscopy, ovarian tumor, postoperative cognitive dysfunction

Introduction

Older adults have reduced organ reserve and wound-healing capacities and weakened immune systems.[1,2] Thus, it is important for perioperative management to rigorously evaluate the patient's ability to withstand the planned anesthesia and surgery. In contrast, when treating giant ovarian masses, the conventional method involves increased invasiveness.

We performed preoperative evaluation of giant ovarian tumors in older adult patients using the comprehensive geriatric assessment (CGA) and estimation of physiologic ability and surgical stress (E-PASS) scoring systems. We report a case in which the Aron Alpha method was performed, and perioperative management was performed using enhanced recovery after surgery (ERAS).

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Materials and Methods

Suspected cases of malignant tumors were excluded from the surgical procedure; however, cases with a possible borderline malignancy or where a malignant tumor could not be completely ruled out underwent the procedure when informed consent was obtained from the patients and their respective families. Among the 24 patients who underwent the Aron Alpha method for giant ovarian tumors (defined in this study as ovarian tumors ≥15 cm along the maximum diameter on preoperative magnetic resonance imaging or pelvic X-ray computed tomography) between January 2016 and September 2022 in our hospital, five who were aged 65 years or older were included in the study. We performed preoperative evaluation using the E-PASS scoring system [Table 1] and CGA.

Surgical technique

Surgery was begun under general anesthesia in the lithotripsy position. A 10-mm scope was inserted from the umbilical region using the open method. After observing the inside of the abdominal cavity (for adhesions and lesions), ascites were collected, and ascites cytology was conducted [Figure 1a].

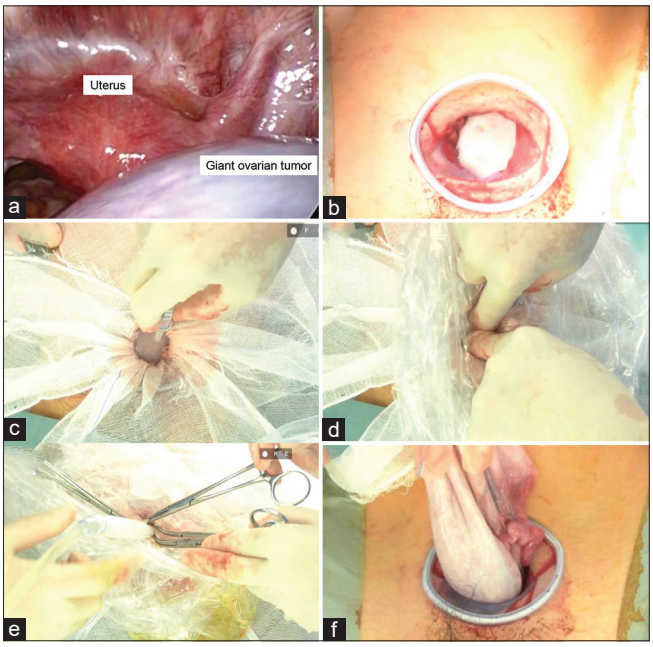

Figure 1: (a) The peritoneal cavity was observed laparoscopically, and ascites were collected and submitted for cytological examination. (b) After observing the abdominal cavity, a small incision of 3 -5 cm was made in the lower abdomen, and a Gosset retractor was attached. (c) Gauze was placed around the tumor to prevent the dripping of Aron Alpha into the surrounding tissue. (d) Aron Alpha was applied to the tumor surface in a grid pattern, and a sterilized plastic bag was placed on the ovarian tumor and adhered. (e) After confirming that Aron Alpha adhered, the plastic was punctured with a knife, and the contents were aspirated with a suction tube. (f) After aspirating some contents, the tumor was guided out of the body, and the contents were further aspirated. After the tumor was lifted out of the body and the running of the ureter was confirmed, the infundibulopelvic ligament was ligated and cut, and the appendage was removed

After observing the abdominal cavity, a small incision of 3–5 cm was made in the lower abdomen, and a retractor (LAP DISC®, Hakko MedicalCo. Ltd., Nagano) was attached [Figure 1b]. To prevent the dripping of Aron Alpha (Aron Alpha A "Sankyo"® [Daiichi Sankyo Co., Ltd., Tokyo]) into the surrounding tissues in advance, we spread gauze around the tumor to prevent adhesion to other organs [Figure 1c]. Aron Alpha was applied to the tumor surface in a grid pattern and manually compressed from within a sterile plastic bag to adhere to the tumor [Figure 1d]. After confirming that Aron Alpha adhered to the tumor, a cross-shaped incision was made inside the plastic bag with a knife, the tumor and plastic bag were clamped with Kocher forceps, and the tumor fluid was aspirated from the plastic bag [Figure 1e]. This procedure prevented the leakage of tumor contents into the peritoneal cavity. After a certain volume of tumor fluid was aspirated, the ovarian tumor was guided out of the body, and the fluid was further aspirated. Thereafter, the tumor was lifted out of the body [Figure 1f], the running of the ureter was confirmed, the infundibulopelvic ligament was ligated and cut, and the affected appendage was removed.

In addition, the contralateral appendage was removed on the affected side by ligating and cutting the infundibulopelvic ligament. After removing the appendages on both sides, the intraperitoneal cavity was washed with physiological saline, and the operation was completed.

Postoperatively, our hospital adopted the ERAS protocol, perioperative management, and early rehabilitation

Table 1: Estimation of physiologic ability and surgical stress scoring system

1. PRS=−0.0686+0.00345X1+0.323X2+0.205X3+0.153X4+0.148X5+0.0666X6
X1, age; X2, presence (1) or absence (0) of severe heart disease; X3, presence (1) or absence (0) of severe pulmonary disease; X4, presence (1) or absence (0) of diabetes mellitus; X5, Performance status index (0–4); X6, American Society of Anesthesiologists physiological status classification (1–5), severe heart disease was defined as heart failure of New York heart association class III or IV, or severe arrhythmia requiring mechanical support. Severe pulmonary disease was defined as any condition with a %VC of <60% and/or a FEV 1.0% of <50%. Performance status index was based on the definition by the Japanese Society for Cancer Therapy
2. SSS=−0.342+0.0139X1+0.0392X2+0.352X3
X1, blood loss/body weight (g/kg); X2, operation time (h); X3, extent of skin incision, 0: Minor incisions for laparoscopic or thoracoscopic surgery (including scope-assisted surgery), 1: Laparotomy or thoracotomy alone, 2: Both laparotomy and thoracotomy
3. CRS=−0.328+0.936 (PRS)+0.976 (SSS)
The E-PASS scoring system consists of a PRS, SSS, and CRS, is calculated from these values. PRS: Preoperative risk score, SSS: Surgical stress score, CRS: Comprehensive risk score, VC: Vital capacity

intervention from the day after surgery. In addition, age, history of pregnancy and delivery, comorbidities, E-PASS scoring system, CGA, operation time, blood loss volume, postoperative complications, histopathological diagnosis, and length of hospital stay were retrospectively examined from the information in medical records. Numerical data are shown as mean ± standard deviation.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by International University of Health and Welfare Ethics Committee (approval no. 22-b-32, approval date: 11/16/2022). The research participants provided verbal and written informed consent for the publication of the images in all figures.

Results

Table 2 shows the backgrounds of the five patients. The mean age was 75.8 ± 8.8 years (65–87 years), all were multiparous, and the mean body mass index was 24.2 ± 3.6 kg/m^2 (21.1–30.2). Comorbidities included hypertension in three cases, hyperlipidemia in two, angina pectoris in one, cholecystitis in one, and lower extremity varicose veins in one. The mean diameter of the tumors was 21.0 ± 5.4 cm (16–28 cm), and the chief complaints were abdominal distension in four cases, with Case 4 being asymptomatic as indicated during the examination. In the examination with the E-PASS scoring system, the preoperative risk score was 0.7 ± 0.4 (0.4–1.2), the surgical stress score was 0, and the comprehensive risk score was 0.3 ± 0.3 (0.4–0.8) [Table 3]. During CGA, instrumental activities of daily living (IADL) and cognitive function problems were observed in Cases 1 and 4, and we performed evaluations of IADL and the mini–mental state examination (MMSE). Case 1 had an IADL of 7 and mild dementia; Case 4 had an IADL of 5 and mild dementia. Table 4 shows the surgical results. The mean operation time was 89.0 ± 16.6 min (65–108 min); additionally, Cases 3 and 5 underwent hysterectomies. The mean blood loss was 56.0 ± 65.4 mL (10–150 mL). None of the patients experienced intraperitoneal rupture.

Ascites cytology was negative in all cases, and histopathological examination results of the excised specimens showed mucinous cystadenoma in two cases, demonstrating mucinous cystadenoma of borderline malignancy, mature cystic teratoma, and endometriotic cystadenoma. Surgical complications were not observed. Furthermore, postoperative management, including early rehabilitation intervention, was conducted beginning the day after surgery based on the ERAS guidelines. The average length of hospital stay was 7.4 ± 0.5 days (7–8 days), with no cases of prolonged hospital stay. None of the patients exhibited a decline in activities of daily living (ADL) or cognitive impairment after hospital discharge.

Discussion

Older adults have reduced overall functions, and comorbidities such as hypertension, diabetes, and organ dysfunctions such as cardiopulmonary dysfunction are commonly exhibited. Furthermore, postoperative dietary intake is slow in older adults, and postoperative complications have been said to increase due to malnutrition and deterioration of functions such as swallowing. Collectively, these factors increase hospital stay length and the risk of postoperative death.[1,2] The general condition, organ functions, and the degree of complications vary in older adults; thus, the decision to conduct surgery should be based on general conditions rather than age alone.

In addition to the E_PASS scoring system,[3] preoperative evaluation methods (that predict postoperative complications associated with general conditions and surgery to ensure postoperative complications are prevented and surgery conducted more safely) adopted in this study include the physiological and operative severity score for the enumeration of mortality and morbidity published in England in 1991,[4] visual acuity score (announced in the United States in 1997),[5] and the Donati et al. model (announced in Italy in 2004).[6] The E-PASS scoring system evaluates and calculates age; presence or absence of severe heart disease, severe lung disease, or diabetes; performance status; and American Society of Anesthesiologists physical status. Furthermore, the surgical invasion score is calculated by evaluating the amount of blood loss per body weight (g/kg), operation time, and area of the

Table 2: Patient background data

Case	Age (years)	BMI (kg/m^2)	Number of pregnancies (count)	Number of deliveries (count)	Comorbidities	Symptoms	Maximum tumor diameter (cm)
1	82	21.8	5	3	Lower extremity varicose veins	Abdominal distension	16
2	72	23.4	5	3	Hyperlipidemia, hypertension	Abdominal distension	25
3	72	21.1	5	2	Cholecystitis, hypertension	Abdominal distension	16
4	87	24.5	4	3	Angina pectoris, hypertension	Asymptomatic	20
5	65	30.2	2	2	Hyperlipidemia	Abdominal distension	28

BMI: Body mass index

surgical incision. Collectively, the scores are combined, and the total risk score is evaluated to calculate postoperative complications and inhospital mortality. This simple system does not require special equipment and can be calculated from general examination and surgical items. Compared to other risk evaluation scores, this system is universally easier to implement, and its usefulness in predicting postoperative complications and inhospital mortality has been reported.[3-6] Supposing the results of the comprehensive preoperative evaluation by the E-PASS scoring system indicate that the patient cannot withstand the anticipated standard anesthesia and surgical invasion, the next best measures need to be considered. In addition, it is thought that evaluating these factors will help in selecting surgical methods such as nonradical surgery, palliative surgery, and nonsurgical treatments.

Furthermore, since the risk of postoperative complications such as delirium is high during the surgical treatment of older adults, risk needs to be estimated from various perspectives before surgery, for which a CGA can be performed.[7] CGA evaluates disease and physical functions required for anesthesia and surgery, cardiopulmonary function, ADL, exercise capacity, nutritional status, cognitive function, communication ability, sensory function, family environment, family support situation, and financial problems; these factors are combined to determine the possibility of surgery tolerance, surgical indications, surgical content, and surgical methods. Although the family environment and financial problems do not directly affect the indication for surgery, it is essential to consider postoperative care and lifestyle before surgery. It has been reported that the provision of medical and welfare services, according to this evaluation, helps reduce the number of hospitalizations, shorten the length of hospitalization, and lower the mortality rate.[8,9] In this study, Cases 1 and 4 had problems with IADL and cognitive function, and evaluations of IADL and MMSE were performed.

In addition, postoperative functional recovery must be considered in older adults. ERAS, reported by Fearon *et al*.,[10,11] aims to reduce postoperative complications and promotes functional recovery by packaging and implementing evidence-based perioperative management strategies to reduce metabolic stress and achieve optimal pain relief, early oral nutrition, and ambulation. Evaluation using ERAS established that minimally invasive surgery to minimize postoperative dysfunction and promote early ambulation contributes to shortening the postoperative hospital stay and reducing the economic burden on patients.[12,13]

In addition, older adult patients may develop postoperative cognitive dysfunction (POCD). The primary risk factor for its onset is aging; the incidence of POCD 1 week after surgery was 30%–50%, and 10%–15% 3 months after surgery, with the majority being older adult patients.[14] A detailed mechanism of POCD onset has not been elucidated; however, the involvement of neuroinflammation is suggested.[15,16] Consequently, perioperative management that suppresses neuroinflammation efficiently is indicated for prevention. Minimally invasive procedures, shortened surgery time, active use of postoperative analgesics and anti-inflammatory drugs, and preoperative exercise and cognitive function training have been suggested to be effective in preventing POCD.[15,16]

In the cases examined in this study, we performed appropriate preoperative evaluation using the E-PASS scoring system and CGA, along with perioperative management based on ERAS such as early postoperative ambulation, rehabilitation intervention, and postoperative analgesic management. Results showed that all patients were discharged as planned without postoperative complications or decline in ADL, and no POCD occurred 2 months after surgery.

However, there were concerns with giant ovarian tumors in terms of identifying them as benign or malignant before surgery. Preoperative diagnosis involves referring to diagnostic imaging

Table 3: Estimation of physiologic ability and surgical stress scoring system for each case

Case	PRS	SSS	CRS
1	1.2	0	0.8
2	0.5	0	0.1
3	0.5	0	0.1
4	1	0	0.6
5	0.4	0	0.1

PRS: Preoperative risk score, SSS: Surgical stress score, CRS: Comprehensive risk score

Table 4: Surgical results

Case	Operation time (min)	Bleeding amount (mL)	Ascites cytology	Histopathological examination	Length of hospital stay (days)
1	99	10	Class I	Mature cystic teratoma	7
2	80	10	Class I	Mucinous cystadenoma	8
3	108	100	Class I	Mucinous cystadenoma of borderline malignancy	7
4	65	10	Class I	Mucinous cystadenoma	7
5	93	150	Class I	Endometriotic cystadenoma	8

and tumor markers, and if necessary, conducting intraoperative cytology and rapid histopathological examination. There have been several cases where the possibility of a borderline malignancy or a malignancy cannot be ruled out, as well as those in which the final pathological diagnosis is a malignant tumor. If the ovarian tumor is malignant, or if tumor content leaks into the peritoneal cavity due to intraoperative capsule rupture, there will be an increased risk of progression of disease stage[17] or recurrence;[18] therefore, it is vital to remove the tumor without allowing tumor fluid leakage into the peritoneal cavity. As a result of this phenomenon, the conventional surgical method entails a larger surgical wound and greater surgical invasion. The surgery should be short and minimally invasive to reduce the risks associated with surgery for older adults. For relatively large ovarian tumors, the Aron Alpha method may be used, which involves the use of laparoscopy, Aron Alpha for medical use, and sterilized plastic bags to conduct a small laparotomy (incision of 3–6 cm) to remove the contents of the tumor without leaking it into the abdominal cavity and to ensure the adhesion of the tumor with the plastic bag. We have previously performed minimally invasive surgery using the Aron Alpha method for giant ovarian tumors and reported its effectiveness.[19] To achieve the desired adhesion, it was necessary for this study to dry the moisture on the surface of the ovarian tumor with gauze and apply the Aron Alpha to the tumor surface at an appropriate amount in a grid pattern to increase the area exposed to air, speed up the polymerization and curing time, and increase the adhesion strength.

After the tumor and sterilized plastic bag were adhered, a cross-shaped incision was made on the tumor in the plastic bag with a knife, and the tumor wall and plastic bag were clamped with Kocher forceps at the four points of the incision. This ensured the adhesion of the plastic bag with the tumor, and by aspirating the contents of the tumor and discharging it out of the body by shrinking the tumor; it was possible to remove the tumor without leaking tumor fluid into the abdominal cavity, thereby contributing to the reduction of surgical invasion and shortening of operation time. In addition, the significance of using a laparoscope in the procedure is as follows: (i) to check for adhesions between the abdominal wall and the tumor, (ii) to help collect ascites without blood contamination, (iii) to make observations of all over the abdominal cavity (including the upper abdomen), and (iv) to help create the possibility of adding biopsy or partial excision for histopathological diagnosis. In cases where there is a peritoneal lesion, it allows for the thorough observation of the peritoneal cavity including its upper portion.

Furthermore, since this surgical technique is easy and inexpensive, it helps resect relatively large ovarian tumors. In the future, we plan to verify the efficacy and safety of this surgical procedure based on older adult patient cases.

Conclusion

It is essential to use the E-PASS scoring system and CGA to evaluate the general condition, cognitive function, and risk of postoperative complications and examine the treatment policy and carry out perioperative management using ERAS when planning surgical treatment for older adults. Furthermore, the Aron Alpha method for giant ovarian tumors is minimally invasive and can be implemented without leakage of the ovarian tumor fluid into the peritoneal cavity. Therefore, this procedure is useful in older adult patients with giant ovarian tumors for which the possibility of malignancy cannot be ruled out.

Author contributions

Kakinuma K and Kakinuma T contributed to conceptualization, methodology, software, validation, original draft preparation, manuscript review and editing, visualization, supervision, and project administration; All authors contributed to formal analysis, investigation, resources, and data curation, and have read and agreed to the published version of the manuscript.

Data availability statement

All data generated or analyzed during this study are included in this published article.

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Conflicts of interest

There are no conflicts of interest.

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