1 INTRODUCTION

Ovarian abscesses usually occur following an infection of the fallopian tubes and commonly develop as tubo-ovarian abscesses (TOAs). TOA is an advanced pelvic inflammatory disease (PID), which often occurs in premenopausal women in their 30s and 40s.1 Ovarian abscesses are caused by several aerobic and anaerobic microorganisms such as gram-negative bacilli (Bacteroides spp. and Escherichia coli) and Streptococcus spp. (S. viridans and S. agalactiae). The ascending route of infection is the most common.

Although TOA tends to occur before menopause, postmenopausal TOA accounts for 6%–18% of all TOAs.2 TOAs can occur secondary to intra-abdominal lesions such as appendicitis3 and diverticulitis.4,5 It is very rare for ovarian tumors to be associated with ovarian abscesses, and approximately 20 cases have been reported to date.5–23

In this article, we report a case of an ovarian mucinous cystic tumor with an abscess in an elderly woman. The cause of fever, leukocytosis, and elevated C-reactive protein (CRP) level was thought to be pneumonia at the time of admission; however, autopsy examination revealed that...
it was due to an ovarian tumor complicated by an abscess. In addition to the case presentation, a review of published cases of ovarian abscesses complicated by the ovarian tumors has been discussed.

2 | CASE HISTORY

An 82-year-old woman undergoing hemodialysis for chronic kidney disease caused by diabetes mellitus was admitted to our hospital with fever and diarrhea. She had previously been diagnosed with a right ovarian mucinous cystic tumor (5 years ago: 8 cm in diameter; 15 months ago: 19 cm in diameter) using abdominal computed tomography (CT) (Figure 1A). It was managed conservatively because she refused to undergo surgery. On admission, her lower abdomen was distended; however, she did not complain of abdominal tenderness. Her body temperature, pulse rate, respiration rate, and blood pressure were 37.5°C, 105/min, regular, 26 breaths/min, and 150/70 mmHg, respectively. The abdomen was soft; the liver and spleen were not palpable, and a soft mass was palpated in the lower abdomen. Routine blood tests were as follows: hemoglobin, 10.1 mg/dl; white blood cell count, 13,000/mm³, with 90% neutrophils; and platelet count, 235,000/mm³. The oxygen saturation of the peripheral artery (room air) was 93%. Blood biochemical studies showed urea nitrogen, 48.2 mg/dl; creatinine, 6.4 mg/dl; glucose, 113 mg/dl; total protein, 6.1 mg/dl; albumin, 2.4 mg/dl; and CRP, 26.35 mg/dl. Blood culture results were negative. Non-contrast abdominal CT revealed a right ovarian mucinous cystic tumor (24 cm in diameter) (Figure 1B). Chest radiography showed an infiltrative shadow in the upper lobe of the right lung, which was confirmed on chest non-contrast CT (Figure 1C). The non-contrast chest CT suggested that the lesion in the right upper lobe could be community-acquired pneumonia, neoplastic lesion, vasculitis, granulomatous disease, or hemorrhage. Of the diseases listed earlier, the possibility of community-acquired pneumonia was considered based on its frequency and blood test results showing inflammation, such as high-CRP levels. The ovarian tumor had gradually increased in size over the past 5 years. Imaging studies during that time showed that the ovarian tumor was not malignant, and therefore, the lung lesion was not considered to be metastatic from the ovarian tumor.

She was treated with ceftriaxone, a broad-spectrum antibiotic often used as the initial treatment for community-acquired pneumonia. During hospitalization, the blood cultures were negative. However, the white blood cell count remained high at 22,800/mm³, with 90% neutrophils and a CRP level of 21.73 mg/dl on the 5th day of hospitalization, implying that the antibiotics were not effective. As her general condition deteriorated, she was not given aggressive treatment and she died 8 days after admission.

An autopsy was performed 5 h after death. The right ovarian tumor occupied the pelvic and lower abdominal cavity and compressed the ileum. The tumor was adherent to the surrounding organs, especially the ileum and the abdominal wall. A small amount of ascites was observed. The tumor weighed approximately 5 kg. The incision of the tumor revealed a multifocal cyst containing 3.5 L of viscous, reddish-brown, and pus-like fluid flowing from the ovary (Figure 2A). Escherichia coli, Bacteroides vulgatus, and Staphylococcus epidermidis were cultured from the ovarian contents. Histologically, the ovarian tumor wall showed dense neutrophil infiltration and abscesses (Figure 2B–D). Most epithelial cells had detached from the wall due to the inflammation; however, the remaining epithelium consisted of columnar cells with mucus in the cytoplasm (Figure 2E),
without invasion. Since the detachment of the epithelium was caused by inflammation, it was difficult to differentiate whether the tumor was benign or borderline. Thus, the ovarian tumor was diagnosed as a mucinous cystic tumor complicated by an abscess caused by bacterial infection.

The adhesions between the ovarian tumor and ileum were manually dissected, and no fistula was observed between the two organs. At the adherent part of the ileum, all the layers of the ileal wall (approximately 40 cm along the long axis) were infiltrated with neutrophils, confirming acute peritonitis (Figure 2F–H).

Acute peritonitis was found only in the ileum, sparing the other organs. The infiltrative shadow in the upper lobe of the right lung seen on the chest radiography and non-contrast chest CT was not pneumonia but an adenocarcinoma (2.9 cm in diameter) (Figure 2I). There was a microscopic accumulation of neutrophils in the liver, suggestive of sepsis, but there were no histological findings of sepsis in the other organs. A few glomeruli remained in the kidney; however, the glomeruli were sclerotic, and the kidney vessels were thickened with fibrous intima, consistent with the histological findings of chronic kidney disease on dialysis.
There are no reviews on ovarian tumors with abscesses without fistulas to other organs, as reported here. We searched PubMed and found 10 similar cases, which are summarized in Table 1. Of the 10 cases, there were seven cases of benign ovarian tumors (six cases of dermoid cyst and one case of mucinous cystadenoma) and three cases of malignant ovarian tumors (two cases of serous carcinoma and one case of squamous cell carcinoma derived from an ovarian dermoid cyst). All were surgical cases of ovarian tumors in patients with complaints of fever or abdominal pain (Table 1). In addition, obvious abscesses with fistulas to the gastrointestinal tract or other organs were found in eight cases, and in half of the cases, abscesses were detected preoperatively on imaging (presence of gas or an air-fluid level in the tumor) (Table 2).

In the 10 ovarian tumors without fistulas in Table 1, no causes of fever or abdominal pain other than the ovarian tumor were found. The ovarian tumors were surgically removed immediately. The inflammatory signs disappeared after surgery, signifying that the inflammatory signs were caused by an abscess within the ovarian tumor. However, in our case, because the chest X-ray and non-contrast chest CT showed shadows in the upper lobe of the right lung on admission, the inflammatory signs such as fever, increased white blood cell count, and elevated CRP were initially thought to be due to pneumonia. This pneumonia-like imaging finding was a major obstacle in predicting the presence of an abscess within the ovarian tumor. If the patient had complained of abdominal pain, probably caused by the ovarian tumor, an oophorectomy would have been considered. Since the patient did not complain of abdominal pain, the possibility of an abscess within the ovarian tumor was not considered.

On admission, a non-contrast abdominal CT was performed to assess the characteristics of the ovarian tumor, but there was no change in the contents of the ovarian tumor compared with the non-contrast abdominal CT performed 15 months earlier. It was difficult to diagnose an ovarian abscess within the ovarian tumor from the non-contrast abdominal CT scan because of the lack of gas or an air-fluid level in the tumor. Since contrast-enhanced abdominal CT had not been performed before admission, it may have been difficult to detect the ovarian abscess associated with the ovarian mucinous cystic tumor, even if contrast-enhanced abdominal CT of the ovarian tumor had been performed at the time of admission.

A history of PID, intrauterine manipulation, or intrauterine contraceptive devices, which are well-known causes of TOA, were absent in the patient. As shown in Figure 2, transmural inflammatory cell infiltration and acute peritonitis were observed in the ileum that was

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**Table 1**  Cases of ovarian tumors with grossly visible abscesses without fistula to other organs reported in the past 30 years

| Author | Year | Age | Histology | Ovary diameter (cm) | Symptom | Microorganism |
|--------|------|-----|-----------|---------------------|---------|---------------|
| Hsueh  | 1992 | 75  | Mucinous cystadenoma | 35×30 | Body weight loss | Streptococcus agalactiae |
| Yoshida| 1993 | 70  | Serous carcinoma | 16 | Fever, abdominal distension, and vaginal bleeding | Escherichia coli, Pseudomonas aeruginosa, Serratia marcescens |
| Uwaydah| 1998 | 37  | Dermoid cyst | 12×11×7 | Fever | Proteus mirabilis |
| Matsuyoshi | 2001 | 14  | Dermoid cyst | 12×6×4 | Fever and abdominal discomfort | Salmonella chester |
| Khan   | 2005 | 77  | Serous carcinoma | 9×6×4 | Fever and abdominal pain | Chlamydia trachomatis |
| Luk    | 2007 | 20  | Dermoid cyst | 10×9.5 | Fever and abdominal pain | Methicillin-sensitive Staphylococcus aureus |
| Spencer| 2011 | 14  | Dermoid cyst | 8.2×7×8 | Fever and abdominal pain | Actinomyces spp. |
| Salehpour | 2013 | 28  | Dermoid cyst | 10×1×2 | Fever and abdominal pain | E. coli |
| Chhabra| 2018 | 8   | Dermoid cyst | 12×1×2 | Fever and abdominal pain | E. coli |
| Bacalbasa | 2020 | 47  | Squamous cell carcinoma (SCC) derived from dermoid cyst | 10×8×7 | Abdominal pain | E. coli, Rodentibacter sulugensis |
| Our case | 2022 | 82  | Mucinous cystic tumor | 24 | Fever | E. coli, Rodentibacter sulugensis |

Abbreviation: N/A, not applicable.
adherent to the ovarian tumor, but no inflammatory infiltration or acute peritonitis was observed in the other parts of the gastrointestinal tract not adherent to the ovarian tumor. The ileitis was probably caused by stagnation of the ileal contents and compression of the local circulation by the tumor. The spread of gastrointestinal inflammation (acute appendicitis, acute diverticulitis, etc.) to the ovary leading to ovarian abscess has been reported.3–5 Therefore, the ovarian abscess could be caused by the spread of bacteria from the ileitis in this case.

As shown in Table 1, the microorganisms causing ovarian abscesses are diverse, and more than one microorganism can be detected in an ovarian abscess. Therefore, even if an ovarian abscess can be diagnosed using imaging, it is difficult to determine an appropriate antibiotic. Currently, surgical resection appears to be the only treatment for ovarian abscesses.

Ovarian tumors complicated by abscesses are extremely rare, and the prevalence is unknown. This case suggests that abscesses may be associated with ovarian tumors. It is important to report similar cases which can be used to develop a method to detect abscesses in ovarian tumors.

### Table 2

| Author | Year | Age | Histology | Ovary diameter (cm) | Symptom | Microorganism | Fistula |
|--------|------|-----|-----------|--------------------|---------|---------------|---------|
| 1 Protopapas | 2004 | 78 | Cyst adenocarcinoma | N/A | Vaginal bleeding and purulent secretion | N/A | Uterus |
| 2 Upadhye | 2005 | 48 | Dermoid cyst | 20×15 | Fever and abdominal pain | Salmonella Typhi | Small intestine |
| 3 Yahagi | 2011 | 61 | Clear cell carcinoma | 26 | Abdominal distension and bloody bowel discharge | N/A | Sigmoid |
| 4 Song | 2012 | 73 | SCC derived from dermoid cyst | 24 | Abdominopelvic discomfort | N/A | Small intestine |
| 5 Shai | 2013 | 57 | Serous carcinoma (high grade) | 7.5 | Fever and abdominal pain | Escherichia coli | Small intestine |
| 6 Min | 2015 | 67 | SCC derived from dermoid cyst | 9.8 | Abdominal pain | N/A | Sigmoid |
| 7 Yi | 2015 | 42 | Dermoid cyst | 11×11 | Abdominal pain | N/A | Rectosigmoid |
| 8 Kizaki | 2016 | 43 | Dermoid cyst | 11 | Fever and diarrhea | N/A | Rectum |

Abbreviation: N/A, not applicable.

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### Conflict of Interest
The authors declare no conflicts of interest regarding the publication of this article.

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All the authors were involved in the preparation of this manuscript. Daisuke Suzuki, Shiori Meguro, and Toshihide Iwashita analyzed all the pathological data and interpreted the clinical data. Masahiro Hashimoto, Hideya Kawasaki, and Isao Kosugi analyzed and interpreted the clinical data. Koji Inagaki contributed to obtaining informed consent for the publication of this case report from the patient’s family. Yasunori Enomoto, Miho Sugiyama, and Maya Fukushima interpreted the data and critically revised the manuscript for intellectual content. All the authors have read and approved the final version of the manuscript.

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All the authors were involved in the preparation of this manuscript. Daisuke Suzuki, Shiori Meguro, and Toshihide Iwashita analyzed all the pathological data and interpreted the clinical data. Masahiro Hashimoto, Hideya Kawasaki, and Isao Kosugi analyzed and interpreted the clinical data. Koji Inagaki contributed to obtaining informed consent for the publication of this case report from the patient’s family. Yasunori Enomoto, Miho Sugiyama, and Maya Fukushima interpreted the data and critically revised the manuscript for intellectual content. All the authors have read and approved the final version of the manuscript.
DATA AVAILABILITY STATEMENT
The authors declare that all the relevant data have been included in this article and are available in this article.

ETHICAL APPROVAL
This case report was approved by the Ethics Committee of the Chutouen General Hospital (approval number: CGH2022-15).

CONSENT
The written informed consent to publish the case details was obtained from the patient.

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