The purpose of the study was to evaluate patients with borderline ovarian tumors.

**Material and methods:** Clinical features, treatment and survival status of 100 patients with borderline ovarian tumors were retrospectively evaluated between 1998 and 2007.

**Results:** Patients’ mean age was 37.75 years (range: 15–72); 22 of them were postmenopausal. Histopathological diagnoses were serous, mucinous, endometrioid and clear cell in 54%, 41%, 2%, and 3% of the patients, respectively; 70 patients had stage IA disease, 8 were at stage IB, 16 at stage IC, 2 at stage IIA, 3 at stage IIIB and 1 at stage IIIC. Restaging laparotomies were performed on 19 patients; fertility-sparing surgery was performed on 52 patients; 2 patients received chemotherapy because of advanced-stage disease. All patients are currently alive. The 5-year disease-free survival rate for 71 cases was 100%.

**Conclusions:** Borderline ovarian tumors have excellent prognoses, and fertility-conserving surgery can be performed in young patients with early-stage disease.

**Key words:** borderline ovarian tumors, survival, fertility-sparing surgery.
Nineteen patients underwent restaging laparotomies after diagnosis. Three patients had pseudomyxoma peritonei. As we could not show gastrointestinal origin in these cases using upper or lower gastrointestinal endoscopies, we accepted them as having primary ovarian origin. Patients' operations are shown in Table 2.

Fertility-sparing surgery (conservation of the uterus and at least one ovary, in patients younger than 40 years) was performed for 52 patients. Patients with advanced disease underwent hysterectomy, bilateral salpingo-oophorectomy, pelvic and para-aortic lymphadenectomy sampling, omentectomy and cytoreductive surgery. No residual tumor was larger than 1 cm after surgery. The 22 patients with advanced disease received cisplatin-based chemotherapy. The mean number of extracted lymph nodes was 14.5 in 22 cases who underwent pelvic and para-aortic lymphadenectomy sampling. One patient had lymph metastasis in 3 of her 16 extracted lymph nodes.

Mean follow-up was 62 ±2 months (range: 4–120 months). All patients in this study are currently alive; the 5-year tumor-free survival rate is 100% for 71 patients; 9 had recurrence (9%); 20 are still within 5 years of their diagnoses. Four patients who had stage IA disease had pregnancies; they delivered with no relevant problems.

Patients’ characteristics (also patients who had serous and mucinous tumor comparing table, diagnostic measurements as well as surgery summary) are shown in Table 3.

Discussion

Borderline ovarian tumors occur in women of all ages, with an average age in the mid-40s. They account for 9.2–16.3% of ovarian malignancies. Serous and mucinous types make up the vast majority; other histological types are endometrioid and clear cell [1–3].

Recent cytogenetic advances have given unique insights into the pathogenesis and behavior of serous borderline ovarian tumors. In several studies, investigators found that only a small subset of serous cystadenomas progress to serous borderline ovarian tumors, and that activating mutations of BRAF and KRAS genes are early events in tumorigenesis of borderline ovarian tumors [9]. Anfinan et al. reported the mean age of 138 patients with borderline ovarian tumors as 46 years; Sanci et al. reported it to be 47.1 years in 96 cases [1–3]. In our study, mean age was 37.8 years – 35.1 years for those with serous tumors, and 42.2 years for patients...
with mucinous tumors. Patients with borderline tumors tend to be younger than those who develop invasive carcinomas [8,11].

Kliman et al. reported 51.3% of 76 tumors to be mucinous and 38.2% serous [10]. In another study, 60% of tumors were mucinous and 37% were serous [11]. In our study, 54% of tumors were serous and 41% were mucinous. Other studies also reported more serous tumors than mucinous tumors in their series [10–12].

Buttin et al. identified micro-invasion by the primary ovarian tumor as a risk factor for recurrence and death [13]. Seidman et al. suggested that borderline tumors be classified as benign and malignant [14]. Survival for patients whose serous borderline tumors were confined to the ovaries was 100%, whereas those with invasive peritoneal implants and with micropapillary serous carcinomas had a 30–40% mortality rate; these tumors were thus classified as carcinomas.

The rate of stage I disease among borderline ovarian tumor diagnoses is reportedly 67.5–91.6% [3–9, 15], it was 94% in our group.

Some authors advise treating with fertility-sparing surgery and adequate surgical staging procedures, especially in young stage I patients, as no such patients have died of tumors [4–6, 11]. Marice et al. reported that conservative management of ovarian tumors with low potential for malignancy significantly increases risk of recurrence, but does not affect overall survival [16]. Morris et al. also noted that recurrence was more frequent in patients treated with ovarian cystectomy than in those treated with oophorectomy [15]. Identifying clinical disease stage is crucial in determining prognosis. The overall 5-year survival rate for patients with stage I disease is reported to be approximately 95% [9–11, 16], but survival rates decrease to 40–75% in stage II and 56–65% in stage III [1–3, 16]. Upstaged disease has been reported at restaging surgery for borderline ovarian tumors after initial conservative surgery [4–6].

Tamokoshi et al. reported that the patients with serous/mucinous tumors at stages II and III had 5- and 9-year survival rates of 91.7% and 73.3%, and 38.9% and 13.0%, respectively [9]. They found patients with advanced mucinous tumors to have poor prognoses—emphasizing the need to develop more effective treatments for mucinous tumors. Similar survival rates were reported by other authors [1–3].

Postoperative treatment of borderline ovarian tumors is controversial. Patients treated with adjuvant therapy reportedly show no difference in survival rate compared with those treated with surgery alone [5–16]. We administered chemotherapy to 22 patients with advanced disease. In one study, most patients received adjuvant chemotherapy and none had recurrent tumor in stage I patients [9]. Others reported recurrence rates of 2–7% in patients with stage I borderline ovarian tumors [1–3]. In our study the recurrence rate for all stages was 9%. Tamokoshi et al. reported that they had a clinically complete response in 5 of 16 patients with residual tumors of <2 cm [9]. Their reported overall response rate was 50% in cases with residual tumors of <2 cm, but they found no effect with cisplatin-based chemotherapy in patients with gross residual tumors, especially with mucinous tumors.

### Table 2. Operations performed for borderline ovarian tumors

| Operation                        | n  |
|----------------------------------|----|
| TAH + BSO                        | 48 |
| USO                              | 26 |
| USO + contralateral cystectomy   | 1  |
| unilateral cystectomy            | 25 |
| PPLA                             | 22 |
| appendectomy                     | 40 |

**TAH + BSO** — total abdominal hysterectomy and bilateral salpingo-oophorectomy; **USO** — unilateral salpingo-oophorectomy; **PPLA** — pelvic para-aortic lymphadenectomy

### Table 3. Patients’ characteristics, treatment, diagnosis and surgery summary

| Age       | mean | range |
|-----------|------|-------|
| premenopausal | 37.75 | 15–72 |
| postmenopausal |   78  |       |

| Borderline ovarian tumors | mean | range |
|---------------------------|------|-------|
| serous                    | 35.13| 42.25 |
| mucinous                  | 9.05 | 5.61  |

| Bilaterally | mean | range |
|-------------|------|-------|
| 17/54       | 5/41 |

| High CA-125 levels (>35 IU/ml) | mean | range |
|--------------------------------|------|-------|
| 31/54                          | 11/41|

| Chemotherapy for advanced disease | mean | range |
|-----------------------------------|------|-------|
| 10/54                            | 8/41 |

| Fertility sparing surgery | mean | range |
|----------------------------|------|-------|
| yes                       | 52/100 | 8–19 |
| no                        | 48/100 | |

| Residual disease** | mean | range |
|-------------------|------|-------|
| 22/100            | 78/100|

| Lymph node positivity | mean | range |
|-----------------------|------|-------|
| 1/22                  | 21/22|

| Extracted lymph node number | mean | range |
|------------------------------|------|-------|
| 14.5                         | 8–19 |

*USG — ultrasonography (mean diameter given)

**Residual disease: (> 1 cm tumor volume after surgery) with pathological confirmation

Current treatment reports are of residual tumors < 1 cm [1–17]. In our study we had no case with residual tumor > 1 cm (with pathological correlation) and had clinically complete responses after chemotherapy in 6 patients with advanced disease.

In conclusion, Patients with borderline ovarian tumors have excellent prognosis. Fertility-conserving surgery can be performed in young patients with early-stage disease.

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