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ORIGINAL ARTICLE

Clinical indices and histological changes over time in ovarian torsion related to ovarian tumors

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Abstract In some emergency surgeries for ovarian torsion, the ovary cannot be conserved because of necrosis. Ovarian necrosis and the time from the onset of symptoms to surgery are likely to be directly correlated. In this study, we retrospectively evaluated the clinical indices from the time of onset of acute abdomen to surgery at our hospital, in patients with tumor-related ovarian torsion. Among cases diagnosed preoperatively with benign ovarian tumors between 1995 and 2010, there were 54 patients who developed acute abdomen that was surgically diagnosed as ovarian torsion. For evaluation, these patients were divided into two groups according to the time from the onset of acute abdomen to surgical intervention as follows: <10 and ≥10 h. C-reactive protein (CRP) levels, leukocyte counts, body temperature, tumor size, and degree of torsion were compared between the two patient groups. Ovarian status based on postoperative histopathology was classified as necrotic, congestive, or normal, and was also evaluated. The mean CRP level was significantly higher in the ≥10-h patient group than in the patients undergoing surgery in <10 h. No differences were observed between the two groups for leukocyte counts, body temperature, tumor size, and mean degree of torsion. Ovarian necrosis was only observed only in patients undergoing surgery at ≥10 h. When tumor-related ovarian torsion is suspected, surgery should be performed within 10 h after the onset of acute abdomen to conserve ovarian function.

Keywords Ovarian tumor · Acute abdomen · Torsion · Emergency surgery · Necrosis

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Background

Ovarian tumor is one of the most common gynecological diseases. Among complications of ovarian tumors, ovarian torsion causes acute abdomen and is an indication for emergency surgery. Torsion has been reported to occur in 6.9–11% of ovarian tumor patients [1, 2]. In general, when ovarian torsion develops, venous blood flow to the ovary is first blocked, followed by abrupt onset of abdominal pain, and then, the arterial blood flow is blocked, then in some cases the ovary becomes necrotic [3] over time. In addition, ovarian tumors can rupture in some patients, resulting in peritonitis and even disseminated intravascular coagulation (DIC) [4]. In the event of necrosis, sometimes the ovary cannot be conserved and oophorectomy is required, and in other cases, even if the ovary can be conserved, ovarian function is lost. However, Mashiach et al. [5] have shown that black-blue ovaries can be preserved with no damage, maintaining future ovarian function. From the aspect of fertility, it is especially important to preserve ovarian

function in pubescent and sexually mature patients with torsion.

Mazouni et al. reported that necrosis was significantly more frequently observed in patients undergoing surgery more than 10 h from the onset of abdominal pain [6]. However, there has been no definitive report on the relationship between the time to surgery and ovarian function in tumor-related ovarian torsion. In this study, we retrospectively examined patients with tumor related ovarian torsion who had undergone surgery at our hospital, and evaluated their clinical indices from the time of onset of acute abdomen until surgery.

Methods

There were 1,723 patients (1,224 laparoscopies and 499 laparotomies) who were preoperatively diagnosed with benign ovarian tumor and underwent surgery at our hospital from January 1995 to December 2010. Among these, there were 54 patients (25 laparoscopies and 29 laparotomies, 29 adnexectomies and 25 ovarian tumorectomies) who underwent surgery because of acute abdomen and who were diagnosed with tumor-related ovarian torsion based on the intraoperative findings.

These patients were divided into the following two groups according to the time from the onset of acute abdomen to surgery: <10 and ≥10 h until surgery. C-reactive protein (CRP) levels (upper limit of normal, ≤0.3 mg/dl), leukocyte counts (reference range, $3.5–8.5\times10^3/\mu l$), body temperature, tumor size, and degree of torsion were compared between the two groups. The degree of torsion was estimated at 90° intervals intraoperatively. Blood samples and body temperatures were obtained approximately 1 h before surgery.

Based on postoperative histopathological examinations of excised ovaries, the subjects were also classified into the following three groups for evaluation: a group in which necrosis was observed in at least some of the ovarian tumor tissues (Fig. 1), a group in which necrosis was not found but congestion was observed, and a normal group in which neither necrosis nor congestion was observed. The two patient groups characterized by time to surgery were compared in relation to the distribution of histopathological classifications.

For statistical analysis, the Student *t*-test was used to evaluate comparisons between the two groups. *P* values <0.05 were considered statistically significant.

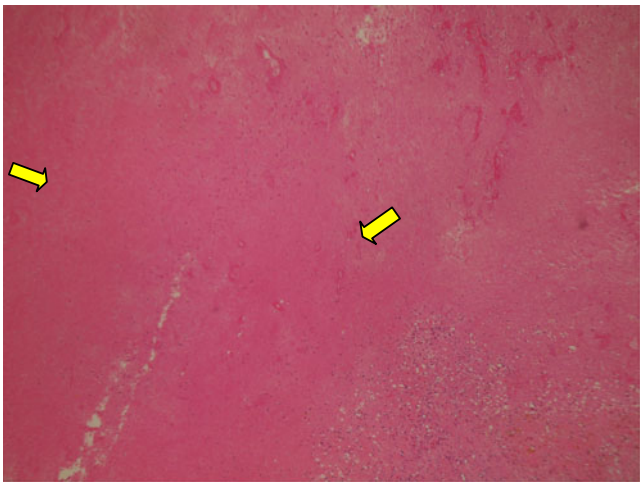

Fig. 1 Pathologic necrosis (H&E, ×40)

Findings

The values of the assessed parameters are shown in Table 1. The mean CRP levels in the patients who underwent surgery 10 h or more after symptom onset were 1.7 mg/dl, and 0.1 mg/dl in patients who underwent surgery in less than 10 h, which was significant. No differences were observed in mean leukocyte counts at $10.1\times10^3/\mu l$ and $10.0\times10^3/\mu l$; in mean body temperatures, at 36.7°C and 37.1°C; in mean tumor sizes, at 8.3 and 9.5 cm; and mean degrees of ovarian torsion, at 506° and 667°, respectively, for the group of less than 10 h and the group of 10 h or more. Regarding histopathlogical findings, there were ten normal and ten congestive histological tissue specimens in the group of patients undergoing surgery less than 10 h after symptoms, whereas there were nine normal, 12 congestive, and 13 necrotic specimens in the patients undergoing surgery at 10 h or more. Necrotic ovaries were only seen in the ≥10-h group. Among the 13 necrotic specimens, there were 11 with partial necrosis and two with complete necrosis, in which the entire tissue was necrotic. The delay was due to transportation from the referring clinic to our hospital (Table 2).

Discussion

Preoperative diagnosis of ovarian torsion caused by ovarian tumor is difficult, and the condition must be differentiated from other emergent gynecological diseases that present with abdominal pain, such as rupture of ovarian tumor, ovarian hemorrhage, uterine adnexitis and ectopic pregnancy. Ovarian torsion has been found

Table 1 Comparisons of data on the two groups of patients classified by time to surgery

	Overall (n=54)	Time <10 h (n=20)	Time ≥10 h (n=34)	P value
CRP[a] (mg/dl)	1.1±2.9 (0–2.9)	0.1±0.3 (0–1.4)	1.7±3.6 (0–12.9)	<0.01
WBC[b] (10^3/μl)	10.1±3.1 (3.2–17.3)	10.1±2.8 (4.7–13.4)	10.0±3.2 (4.2–17.3)	n.s.
Temperature (°C)	36.9±0.7 (35.9–38.7)	36.7±0.5 35.9–37.7)	37.1±0.7 (35.6–38.7)	n.s.
Tumor diameter (cm)	9.1±3.3 (3.6–20.0)	8.3±2.8 (4.5–15.0)	9.5±3.6 (3.6–20.0)	n.s.
Degree of torsion (°)	607±309 (120–1260)	506±258 (120–900)	667±325 (180–1,260)	n.s.

n.s. no significant difference

[a] CRP upper limit of normal: ≤ 0.3 mg/dl

[b] White blood cell count reference range: 3.5–8.5×10^3/μl

to represent between 2.5% and 7.4% of surgical cases of acute abdomen [7, 8]. Thus, it is not uncommon for the diagnosis to be made only after emergency diagnostic laparoscopy [9, 10]. Currently, there is no specific blood biomarker for tumor-related ovarian torsion [11, 12]. In suspected torsion, it is of primary importance to diagnose the torsion as soon as possible for emergent surgery, but it is also important to determine whether the affected ovary can be conserved by assessing for necrosis. However, determining the necrotic status of an ovary preoperatively is difficult. Mazouni et al. reported that necrosis was more frequently observed in cases in which more than 10 h had passed since the onset of abdominal pain [6]. On the other hand, Bar-On et al. reported that patients undergoing operations less than 10 h after admission were statistically more likely to have ovarian torsion [13]. In this study, the mean CRP level was significantly higher in the group undergoing surgery at 10 h or more than in the group undergoing surgery at less than 10 h. Histologically confirmed necrosis was only observed in the group undergoing surgery at 10 h or more. Some studies have reported that ovarian torsion could occur following ovarian stimulation [14–16]. In this study, however, all ovarian torsion cases were associated with ovarian tumor.

Therefore, ovarian necrosis caused by ovarian torsion associated with an ovarian tumor tends to develop when more than 10 h have elapsed since the onset of acute abdomen, and development of necrosis leads to an elevated CRP level. The results of this study also indicate that if ovarian torsion is suspected, surgery should be performed as soon as possible at least within 10 h after the onset of acute abdomen to conserve ovarian function. In our hospital, surgery is performed promptly for an inpatient when ovarian torsion is suspected. The cases that were delayed were primarily those cases transported from other hospitals. Therefore, if the hospital does not have the appropriate operating facilities, prompt arrangement of transportation is necessary for a patient with suspected ovarian torsion.

Table 2 Number of cases according to histopathological status in the two groups of patients classified by time to surgery

	<10 h (range)	≥10 h (range)	Total
Normal	10 (3–9 h)	9 (10–31 h)	19
Congestive	10 (4–6 h)	12 (10–27 h)	22
Necrotic	0	13 (10–264 h)	13
Total	20	34	54

Conclusion

In all the cases in this study that were classified in the necrotic group for evaluation, necrosis was seen in least a part of the tissue specimen. Although we cannot conclude from our findings that ovarian function would be lost in every patient in the necrotic group, if torsion is suspected, we believe that immediate action is necessary to preserve ovarian function. Also, in any cases where the torsion is suspected, surgery should be performed as soon as possible.

The limit of this present study is that 10 h was taken as cut-off reference time on the basis of the result indicated in the study by Mazouni et al. However, time to surgery is a continuous variable, and the cases should have been investigated at different time points especially regarding the torsion of ovary. We will address this issue more precisely in the future study, taking the time parameter as a continuous variable.

Conflicts of interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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