

# Evaluation of immediate laparoscopic surgery for gynecologic disorders

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**Abstract** The purpose of this study was to obtain information to aid in deciding the timing of immediate laparoscopic surgery for gynecological disorders. We evaluated immediate laparoscopic surgery (within 12 h after admission) performed at our institution between January 2005 and March 2010. Of the total 287 laparoscopic surgeries performed for patients with gynecological disorders during this period, 70 (24.4%) were immediate laparoscopic surgeries, 33 (47.1%) of which were for ectopic pregnancy, and 24 (34.3%) for ovarian tumor. Among the 24 surgeries for ovarian tumor, there were almost equal proportions of surgeries for mature cystic teratoma (ten cases, 41.7%) and endometrioma (nine cases, 37.5%). As to the breakdown of immediate surgery by pathology, immediate surgeries were performed in 20.8% of mature cystic teratoma cases and in 12.9% of endometrioma cases during this study period. In the 24 immediate surgeries for ovarian tumor, 10 cases (41.7%) had neither torsion nor rupture, 7 cases (29.2%) had torsion with mature cystic teratoma, serous cystadenoma or follicular cyst, and 7 cases (29.2%) had rupture of the tumor, all of which were endometrioma. Preoperatively, there were no significant differences between torsion and non-torsion cases in serum white blood cell (WBC) count or C-reactive protein (CRP) levels in peripheral blood. However, serum WBC and CRP levels tended to be elevated in cases of rupture with endometrioma. Especially in patients with ovarian tumor, presumed pathology is important in deciding the timing of immediate laparoscopic surgery.

**Keywords** Endometrioma · Immediate surgery · Laparoscopy · Ovarian tumor · Ovarian torsion

## Background

Laparoscopic surgery has increasingly been applied in recent years to treat a number of gynecological disorders. Compared with laparotomy, laparoscopy has several benefits such as better cosmetic results, a more rapid recovery, shorter hospital stay, less blood loss, and reduced postoperative pain [1, 2]. Thus, physicians either prefer or are required to perform unscheduled laparoscopic surgery (within 12 h after admission) for emergency cases. In such cases for women, ectopic pregnancy and ovarian torsion are the two most common disorders [3, 4]. Due to possible maternal morbidity and occasionally mortality, the timely and appropriate treatment of ectopic pregnancy is important. For ovarian torsion too, diagnosis and treatment in a timely and appropriate manner is important because delay may have grave consequences, such as functional loss of the ovary.

Immediate surgery should be performed to prevent disease progression and to remove symptoms such as abdominal pain. However, as laparoscopic surgery requires sufficient numbers of experienced staff (including physicians, anesthesiologists, nurses and clinical engineers) compared with laparotomy, in rural areas where the total number of doctors has been reducing, immediate laparoscopic surgery, especially at night, imposes a burden on gynecologists and anesthesiologists. Since 2005, laparoscopic surgery has been performed by fixed operators at our institution, Shimane University Hospital. From January 2005 to March 2010, 287 patients underwent laparoscopic surgery for gynecological disorders at the hospital. Among

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the total laparoscopic surgeries performed, immediate surgeries were retrospectively evaluated to obtain information to help decide the timing of the immediate laparoscopic surgeries.

## Methods

A retrospective medical record review was conducted at Shimane University Hospital in Shimane prefecture, Japan. The medical records of all women who underwent laparoscopy for gynecologic disorders at some time between January 1, 2005 and March 31, 2010 ( $n=287$ ) were reviewed. Only women who underwent laparoscopy within 12 h after admission were assigned to the immediate surgery group ( $n=70$ , 24.4%). Medical history was taken by a physician, and all patients gave informed consent for the surgery. A single investigator reviewed each record and abstracted the data.

Due to the limited number of operators for laparoscopy, both laparoscopy and laparotomy have been applied in emergency cases at our hospital. Furthermore, laparotomy is performed if patients do not insist on laparoscopy. The first author (H.K.) participated in all of the immediate laparoscopies reviewed in the present study. Pathologic specimens were also studied by one senior pathologist. In cases where pregnancy-related symptoms were doubtful, urinary hCG levels were checked. Before surgery, all patients underwent physical examination, pelvic examination, and trans-abdominal or trans-vaginal ultrasonography. Blood counts and a blood coagulation test as well as biochemical examination were also evaluated for peripheral blood.

In laparoscopy surgery, after general anesthesia, a 10-mm trocar was inserted just below the umbilicus and insufflated with carbon dioxide at a pressure of 10 mmHg. On direct view, two trocars (12 or 5 mm) were placed through lower abdominal incisions. For management of benign ovarian cyst, after an incision was made on the antimesenteric surface of the cyst, two atraumatic grasping forceps were used to pull the cyst wall and the normal ovarian parenchyma in opposite directions so that the cyst wall could be stripped from the bed of normal ovarian tissue. If the ovary and adnexal lesion were completely distorted and showed necrotic change in color, oophorectomy, and adnexectomy using the Ligasure™ vessel sealing system (Covidien, Boulder, CO) was conducted.

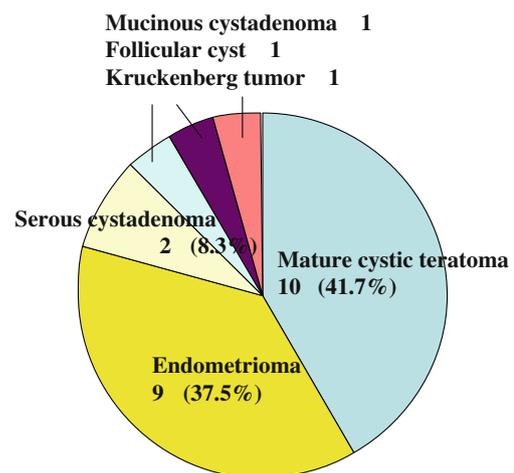
Difference in the levels of serum white blood cell (WBC) count and C-reactive protein (CRP) were determined using an unpaired  $t$  test.  $P<0.05$  was considered statistically significant (student's  $t$  test).

## Findings

From a total of 287 laparoscopic surgeries performed to treat gynecological disorders at our hospital from January 2005 to March 2010, immediate laparoscopic surgery (within 12 h after admission) was carried out in 70 cases (24.4%). Immediate surgery was chosen principally to eliminate pain or avoid risks associated with delayed surgery.

Of the 70 immediate surgeries performed, 33 (47.1%) were for ectopic pregnancy, 24 (34.3%) for ovarian tumor, 9 (12.9%) for ovarian hemorrhage, 3 (4.3%) for ovarian hyperstimulation syndrome, and in 1 case (1.4%) the patient wanted to undergo laparoscopic tubal ligation within 12 h after vaginal delivery. Among the 33 cases of ectopic pregnancy, rupture of the fallopian tube was noted in 10 cases (41.7%). Laparotomy was routinely performed in patients in shock, but immediate laparoscopy was not performed in cases of ectopic pregnancy with shock. Postoperative pathological findings of the 24 cases of ovarian tumor are shown in Fig. 1. Among these cases, ten (41.7%) had mature cystic teratoma, nine (37.5%) endometrioma, and two (8.3%) serous cystadenoma. Laparoscopic surgery was performed for a total of 172 cases of ovarian tumor in the study period, 70 (40.7%) of which were for endometrioma and 48 (27.9%) for mature cystic teratoma.

Despite there being a larger total number of surgeries for endometrioma than for mature cystic teratoma, there were still a considerable number of immediate surgeries for mature cystic teratoma. The breakdown of immediate surgery by ovarian pathology during the study period is shown in Table 1. Among the 48 cases of mature cystic teratoma, immediate surgery was performed in 10 cases (20.8%), whereas among the 70 cases of endometrioma,



**Fig. 1** Pathological findings of the ovary in immediate laparoscopy cases

**Table 1** Pathological findings of cases with ovarian tumor and rate of immediate surgery

	Total laparoscopy (n=172)	Immediate laparoscopy (n=24)	%
Mature cystic teratoma	48	10	20.8
Endometrioma	70	9	12.9
Serous cystadenoma	38	2	5.3
Mucinous cystadenoma	9	1	11.1
Others	7	2	28.6

immediate surgery was performed in 9 cases (12.9%). Immediate surgery for mature cystic teratoma was more likely to be performed due to sudden onset of symptoms.

For patients with ovarian tumor, immediate laparoscopic surgery was performed in order to avoid irreversible adnexal damage due to ovarian torsion or eliminate abdominal pain caused by tumor rupture. As for the operative findings for the 24 cases of ovarian tumor, in 10 cases (41.7%), neither torsion nor rupture was observed, and removal of the tumor improved the symptoms. Ovarian torsion was observed in seven cases (29.2%), namely four with mature cystic teratoma, two with serous cystadenoma, and one with follicular cyst. Among these seven cases of ovarian torsion, ovariectomy was performed in two cases. In one case, unilateral adnexa were completely twisted with necrotic changes of the ovary and, in another case, although there were no such necrotic changes, bilateral oophorectomy was performed because the patient was 55 years old. In the remaining five cases, detorsion and cystectomy of the ovarian tumor were performed because the adnexal damage was not irreversible. Furthermore, torsion of endometrioma was not observed. Rupture of ovarian tumor, however, was found in seven cases (29.2%) of endometrioma.

For ovarian tumors, accurate preoperative diagnosis is important in deciding the timing of surgery. To predict irreversible damage due to adnexal torsion, serum WBC and CRP levels in peripheral blood are generally used as markers for necrotic change. To examine the usefulness of these markers in the accurate diagnosis of ovarian torsion, preoperative differences in serum WBC and CRP levels were compared between a torsion group ( $n=7$ ), in which at least one complete adnexal twist was observed, and a control group ( $n=8$ ). Here, it is important to note again that torsion of endometrioma was not observed in this study so cases of endometrioma were excluded from the control group. For both serum WBC count and CRP levels, there was no significant difference between the two groups (Fig. 2).

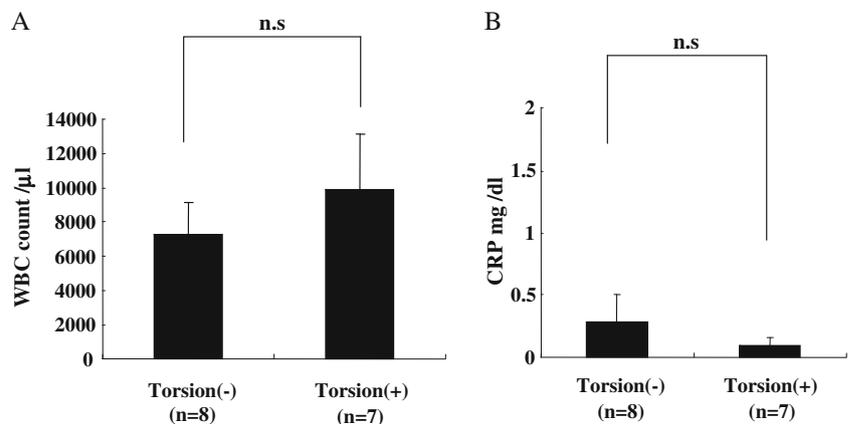
Seven of the nine patients with endometrioma had rupture of endometrioma. Preoperative WBC and CRP levels in these cases are shown in Table 2. Since non-ruptured endometrioma was found only in two cases, we could not statistically compare the laboratory data between a control group and a ruptured group. Generally, serum WBC and CRP levels tended to be elevated in ruptured cases. In some cases, both WBC and CRP were elevated, and in other cases, only one of them was elevated.

## Discussion

Immediate laparoscopic surgeries performed for gynecologic disorders at our institution were reviewed in the present study. The first author (H.K.) introduced laparoscopic surgery in the institution from January 2005, and since then, almost 300 surgeries have been performed by the same staff.

Recently, laparoscopic surgery has become the first choice for treating ectopic pregnancy and benign ovarian tumors due to its several benefits such as faster recovery, enhanced visualization, shorter hospital stays [1, 2], and

**Fig. 2** Preoperative serum WBC (a) and CRP levels (b) in patients with ovarian torsion



**Table 2** Preoperative serum WBC and CRP levels in the patients with endometrioma

	Patient age (years)	WBC (ml)	CRP (mg/dl)
Ruptured cases (n=7)	40	5970	4.0
	22	11230	0.2
	24	17420	–
	28	11610	10.31
	27	6620	9.06
	27	24700	0.9
	32	8420	3.72
Unruptured cases (n=2)	22	6100	0.2
	27	6850	0.07

less potential for adhesion formation [5]. In addition, single incision laparoscopic surgery and natural orifice transluminal endoscopic surgery have attracted widespread attention for the cosmetic benefits they afford [6, 7]. Given these benefits and the popularization of laparoscopic surgery, we gynecologists need to decide whether to perform a laparoscopy or laparotomy when faced with patients who present with acute abdomen or patients who require unscheduled laparoscopic surgery.

It is generally agreed that laparoscopy requires special techniques and operators need special, time-consuming training. Therefore, not all gynecologists can perform laparoscopic surgery for patients who require emergency treatment. In addition, a number of devices such as monitors, forceps, and camera monitors should be prepared, and understanding and cooperation between anesthesiologists and other surgical staff are necessary, especially when working overtime. This review of our cases of unscheduled (immediate) laparoscopic surgery was designed to create a guide to help physicians decide the timing of immediate laparoscopy.

Among the immediate laparoscopies evaluated, almost half of them were performed for patients with ectopic pregnancy. Although higher persistent trophoblast rates with laparoscopic surgery have been reported by other studies [5, 8], laparoscopic surgery is generally favored because of its benefits such as less blood loss and lower costs. Banz et al. concluded that laparoscopic salpingostomy, which was performed for 84.9% of a total of 473 women with ectopic pregnancy during their 9-year study period, was a safe and effective treatment [3]. In the present study period (January 2005 to March 2010), a similarly high proportion of ectopic pregnancies (94.3%; 33 of 35) were treated successfully with immediate laparoscopy at our institution.

Of the immediate laparoscopies performed overall, 34.3% were for the treatment of ovarian tumor. Through a review of the pathological findings, we noted that immediate laparoscopy was more likely to be carried out in cases

of mature cystic teratoma in the ovary than in cases of endometrioma (20.8% and 12.9%, respectively) (Table 1). All patients who underwent immediate surgery presented with signs and symptoms such as pain, vomiting, nausea, and tenderness, from which we suspected torsion or rupture of an ovarian tumor. However, for the 24 cases of immediate laparoscopy for ovarian tumor, 10 (41.7%) had neither torsion nor rupture. In other words, we could have avoided ten immediate surgeries and probably scheduled them with adequate preparation.

Obvious torsion was observed in 7 of the 24 cases of ovarian tumor in the present study. Torsion was noted in mature cystic teratoma, serous cystadenoma, and follicular cyst. There were no cases of torsion of endometrioma. Accurate diagnosis of ovarian torsion is difficult, and previous studies have demonstrated a low rate of accurate preoperative prediction [4, 9]. Signs of necrotic change indicated by elevated WBC and CRP levels are uncommon for ovarian torsion [10]. There were no significant differences in the serum levels of WBC and CRP between torsion cases and non-torsion cases in the present study (Fig. 2). As serum markers are not reliable enough to diagnose ovarian torsion accurately, sonographic findings of ovarian tumor (e.g., appearance of cystic, solid or complex mass, adnexal location that is cranial to the uterine fundus, thickening of adnexal wall, unilateral ovarian enlargement with multiple peripherally located follicles, and cystic hemorrhage) would be more useful as a predictor and to decide upon immediate surgery for ovarian torsion [11]. Doppler studies are also a promising tool for the diagnosis of ovarian torsion [12].

Rupture of ovarian tumor was found in seven cases, all of which were endometrioma. Prediction of ovarian tumor rupture is not an easy matter unless the tumor diameter has diminished or it is detected in the fluid of the pelvic cavity by diagnostic imaging. Although we did not statistically analyze serum WBC and CRP levels in the patients with ruptured endometrioma due to the low number of cases, the levels tended to be elevated. Endometrioma is relatively diagnosed by transvaginal ultrasound scan with its characteristic feature of homogeneous low level echoes in a cystic mass [13]. Thus, we need to suspect tumor rupture in cases of pelvic pain and endometrioma when serum WBC and CRP levels are elevated. Ovarian endometrioma is often accompanied by endometriosis in the pelvic cavity which forms adhesions. Pelvic adhesion may restrict mobility of the uterine adnexal region which can result in rupture but not torsion.

## Conclusion

In this study, we reviewed immediate laparoscopic surgeries performed to treat gynecologic disorders at our institution.

Immediate surgery was principally performed in cases of ectopic pregnancy, which accounted for almost half of the cases (46.5%). Immediate laparoscopies for ovarian tumor were the next most frequent immediate surgeries performed. In the cases of ovarian tumor where immediate laparoscopy was selected based on clinical symptoms, no evidence of ovarian torsion or rupture was observed in 41.1%. Ovarian torsion was observed only in cases that had mature cystic teratoma, serous cystadenoma or follicular cyst. Furthermore, there were no cases of torsion of endometrioma, but there were cases of rupture, all with endometrioma. Serum WBC and CRP levels are not reliable indicators for the diagnosis of ovarian torsion, but they tend to be elevated in rupture of endometrioma. Laparoscopy is generally recognized to have several benefits such as faster recovery, shorter hospital stays, and less potential for adhesion formation. In addition, postoperative pain is light compared to that following laparotomy. Accordingly, laparoscopy is one of the techniques we gynecologists should learn and be sufficiently practiced in. The trends for immediate laparoscopic surgery that we found in our review can help physicians decide whether laparoscopy should be performed immediately, even during the night, or whether it is possible to watch and wait and schedule laparoscopy with adequate preparation.

**Declaration 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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