



Figure 2. Laparoscopic approach in a pregnant woman with isolated fallopian tube torsion in the third trimester. Insertion sites of 5 mm trocars (A). Laparoscopic image of the right fallopian tube torsioned by 720 degrees (B). The right ovary is not included in this torsion and the right fallopian tube has an ischemic appearance (C). Ischemic right tube with the paratubal cyst excised by a Ligasure (D).

informed consent was obtained. Preoperatively, 12 mg of intravenous betamethasone was given for fetal lung maturation, 100 mg of rectal indomethacin for tocolysis, and 1 g of intravenous cefazolin for antibiotic prophylaxis. After general anesthesia in the supine position, the stomach was emptied with a nasogastric tube. A 5 mm trocar was entered into the abdomen from Palmer's point and the pressure was adjusted to 10 mmHg to provide pneumoperitoneum. Then, two 5 mm trocars were placed in the abdomen from the left subcostal and inguinal area (Figure 2a). The patient was placed in the left lateral oblique position to minimize the compression on the inferior vena cava. In the intraperitoneal exploration, it was observed that the right fallopian tube and paratubal cyst were torsioned by 720° (2 rotations), and the fallopian tube was necrotic (Figure 2b-d). The right ovary was not involved in this torsion. Since the color tone of the fallopian tube did not recover after detorsion, the right salpingectomy and cystectomy were performed. The excised fallopian tube and paratubal cyst were placed in the endobag and removed from the abdomen. Pathological examination of the fallopian tube and paratubal cyst was reported as necrotic fallopian tube and benign paratubal cyst.

In the post-operative period, tocolysis was continued with 25 mg oral indomethacin every 6 h for 48 h, and a second dose of 12 mg betamethasone was administered 24 h after the first dose of betamethasone. At the 12th post-op-

erative h, 4000 units of low molecular weight heparin were started for thromboprophylaxis. The patient was discharged on the second post-operative day and routine obstetric follow-ups were continued. A 3375 g male infant was delivered by cesarean section at the 39th week of gestation. Both ovaries and left fallopian tubes were normal in cesarean section.

REVIEW OF LITERATURE

A literature review was conducted according to the PRISMA guideline. We searched all relevant articles in the international electronic bibliographic database PubMed using a combination of comprehensive search criteria and international MeSH terms. The search was limited to articles published in the English language. We used the following words for selection: "laparoscopy," "tube torsion," "salpingectomy and pregnancy," and "tubal torsion and pregnancy." Two independent researchers selected the most relevant articles by evaluating article titles and abstracts, or the full text if the abstract did not provide sufficient information. Letters to editors, editorials, review articles, duplicates, and meta-analysis were excluded from the study. We included only reports involving pregnant women diagnosed with isolated tubal torsion in the third trimester and treated with the laparoscopic approach. We excluded that studies with ovarian or adnexal torsion,

isolated fallopian tube torsion are long fallopian tube, hematosalpinx, hydrosalpinx, paratubal cysts, tubal ligation, fallopian tube neoplasms, and pelvic adhesions, but it can also occur in healthy fallopian tubes without any risk factors.^[8,9] Furthermore, trauma is identified as one of the contributing factors to torsion,^[9] which affects approximately 8% of pregnancies with complications.^[10] However, no signs of trauma were observed in this case.

Patients usually have localized acute abdominal pain accompanied by nausea and vomiting at first admission.^[11] In patients whose treatment is delayed, necrotized fallopian tube due to torsion may cause peritoneal irritation and patients may present with acute abdomen. Since the clinical presentation is non-specific, the diagnosis is based on imaging modalities such as ultrasonography and MRI with a high degree of suspicion. Prompt diagnosis and emergency surgical treatment are essential in pregnant women with isolated fallopian tube torsion, as necrotic tubal tissue may cause preterm delivery, even fetal loss, and maternal morbidity.^[12]

The causes of acute abdominal pain during pregnancy may be obstetric (ectopic pregnancy, pre-term delivery, placental abruption, etc.) gynecological (hemorrhagic ovarian cyst, ovarian cyst rupture, torsion or degeneration of the leiomyoma, tubo-ovarian abscess, etc.), gastrointestinal (acute appendicitis, bowel obstruction, bowel perforation, cholecystitis, etc.), and urinary tract (nephrolithiasis, pyelonephritis, ureteral or renal colic, hydronephrosis, etc.) pathologies, and differential diagnosis may be difficult. Ultrasonography is the first-line diagnostic modality in pregnant women, and isolated tubal torsion is suspected when the ipsilateral ovary appears normal with a paraovarian cyst or hydrosalpinx.^[6] However, it is not easy to evaluate the adnexa in the third trimester due to uterine enlargement. Moreover, as in our case, most cases of isolated fallopian tube torsion during pregnancy reported in the literature are right-sided,^[13] making it difficult to exclude acute appendicitis, which is a common cause of acute abdomen in pregnancy. Considering that the appendix is not always visible on ultrasonography, especially in the third trimester, MRI may be helpful in the differential diagnosis. However, in most of the cases, the definitive diagnosis is made by surgical exploration.^[13]

Physicians may have a conservative tendency such as “wait and see approach,” especially in pregnant women with acute abdominal pain in the third trimester. In a recently published study, the mean time from admission to surgery was significantly shorter in patients in the first trimester compared to late pregnancy.^[7] This is probably related to the difficulty of distinguishing acute abdominal pain from other causes such as premature delivery and the tendency of physicians to avoid surgical intervention in the third trimester. However, such an approach for the torsioned fallopian tube would result in infection in the abdominal cavity and an increased risk of maternal and fetal morbidity and mortality. Therefore, early surgical intervention should be performed in pregnant women with acute abdominal

pain and signs of acute abdomen, regardless of gestational week, unless clearly denied by imaging modalities.^[12]

The traditional approach for the diagnosis and treatment of isolated tubal torsion in pregnancy is exploratory laparotomy. On the other hand, the laparoscopic approach in pregnancy can be used with similar overall outcomes for maternal and fetal well-being.^[14] In the literature review, a total of five cases were reported, including the present case, in which isolated fallopian tube torsion was successfully treated with the laparoscopic approach in the third trimester (Table 1).^[8,11,12,15] The present study provides evidence that the laparoscopic approach performed by experienced operators is safe in the treatment of isolated fallopian tube torsion in the third trimester. Except for uterine contractions in one case, no perioperative or post-operative maternal and fetal complications were observed in any of the previously reported cases, and all cases could be completed laparoscopically. Since the fallopian tube was ischemic during treatment, salpingectomy was performed in most of the patients treated with the laparoscopic approach, as in laparotomy.^[6] In addition, all of the pregnant women who underwent laparoscopy in the third trimester delivered at term, and no complications were encountered in the follow-up of the pregnant women until delivery.

Conclusion

Isolated fallopian tube torsion may cause acute abdominal pain in the third trimester. Although ultrasonography and MRI are guiding, the definitive diagnosis is made by surgical exploration. The laparoscopic approach, which will be performed by an experienced operator in minimally invasive surgery, can be safely applied in the treatment of pregnant women with isolated fallopian tube torsion, even in the third trimester.

Informed Consent

Retrospective study.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: E.E.A., M.A.; Design: T.T.; Supervision: T.T.; Data: H.L.; Analysis: M.A., H.L.; Literature search: E.E.A., H.L.; Writing: E.E.A., H.L.; Critical revision: T.T.

Conflict of Interest

None declared.

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