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Management of Non-obstetric Acute Abdomen During Pregnancy: A High Volume Maternity Center Experience

Gebelikte Doğumsal Olmayan Akut Karın Yönetimi: Yüksek Volümlü Doğum Merkezi Deneyimi

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ABSTRACT

Introduction: The objectives of this study are to analyse and present the cases of pregnant patients who were operated due to non-obstetrical causes, and discuss the ideal diagnostic and therapeutic approaches in the light of current literature.

Methods: We retrospectively reviewed the medical records of pregnant patients who underwent surgery because of non-obstetric pathologies at our clinic between January 2013 and December 2019. Additionally, we evaluated the data of patients such as their demographics, gestational age, clinical and operative findings, diagnostic and therapeutic modalities, hospital stay time, maternal/foetal mortality, and morbidities.

Results: The study cohort consisted of 52 patients who underwent non-obstetrical surgery. The patients' mean age was 26.8±7.1 years. In total, 44% of all cases were in the second trimester. There were following indications for surgery among patients: acute appendicitis (AA) in 67%, acute biliary pancreatitis in 17%, acute cholecystitis in 4%, ovarian cyst rupture in 4% and other indications in 8% of patients. Laparoscopy was used in 35% of the operations, whereas 2% of the patients required postoperative intensive care unit support. Preterm delivery occurred in 6%, and miscarriage occurred in 2% of all cases. Foetal/maternal mortality was 2% in all cases. Moreover, 49% of AA cases were observed in the second trimester. Negative appendectomy rate was 9%. The number of perforated cases was six (17%). Five cases with perforated AA developed wound infection and were treated conservatively.

Conclusion: Understanding anatomical and physiological changes in pregnancy, gaining sufficient information about the safe limits of radiological imaging, and a multidisciplinary systematic approach are indispensable for the timely diagnosis and treatment of pregnant women presenting with acute abdomen. Open or laparoscopic surgery for non-obstetric indications during pregnancy can be performed safely, without increases in maternal and foetal mortality, miscarriage, and preterm delivery rates.

Keywords: Non-obstetric surgery, acute abdomen, pregnancy, acute pancreatitis, acute appendicitis

ÖZ

Amaç: Çalışmamızın amaçları obstetrik olmayan nedenlerle ameliyat edilen gebe hastaları analiz etmek ve sunmak mevcut literatür ışığında ideal tanı ve tedavi yaklaşımlarını tartışmaktır.

Yöntemler: Ocak 2013 - Aralık 2019 tarihleri arasında kliniğimizde obstetrik olmayan patolojiler nedeniyle ameliyat edilen 52 gebenin tıbbi kayıtları retrospektif olarak incelendi. Hastaların demografik özellikleri, gebelik yaşı, klinik ve operatif bulgular, tanı ve tedavi yöntemleri, hastanede kalış süresi, anne/fetal mortalite veya morbidite verileri değerlendirildi.

Bulgular: Çalışma grubu obstetrik nedenli olmayan cerrahi uygulanan 52 hastadan oluşmakta idi. Hastaların ortalama yaşı 26,8±7,1 idi. Tüm olguların %44'ü 2. trimesterde saptandı. Ameliyat endikasyonları olguların %67'sinde akut apandisit, %17'sinde akut biliyer pankreatit, %4'ünde akut kolesistit, %4'ünde over kist rüptürü ve %8'inde diğer endikasyonlardı. Tüm ameliyatların %35'i laparoskopik yapıldı. Ameliyat sonrası yoğun bakım ünitesi desteği %2 olguda gerekli oldu. Tüm olguların %6'sında erken doğum, %2'sinde düşük meydana geldi. Fetal /maternal mortalite oranı tüm olgularda %2 idi. Akut apandisit olgularının %49'u 2. trimesterde saptandı. Negatif apendektomi oranı %9 idi. Altı olgu (%17) perfore idi. Perfore akut apandisitli beş olguda yara yeri enfeksiyonu gelişti ve konservatif olarak tedavi edildi.

Sonuç: Gebelikteki anatomik ve fizyolojik değişiklikleri anlamak, radyolojik görüntülemenin güvenli sınırları hakkında yeterli bilgiye sahip olmak ve multidisipliner sistematik bir yaklaşım, akut karın ile başvuran gebelerin zamanında tanı ve tedavisi için vazgeçilmezdir. Gereklilik halinde, gebelikte obstetrik olmayan endikasyonlar için, açık veya laparoskopik cerrahi, maternal ve fetal mortalite, düşük ve erken doğum oranlarında artış olmadan güvenli bir şekilde yapılabilir.

Anahtar Kelimeler: Obstetrik olmayan cerrahi, akut batın, gebelik, akut pankreatit, akut apandisit

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Introduction

The differential diagnosis of acute abdomen during pregnancy is extensive because this condition may be caused by any of the gynaecologic or obstetric diseases related to gestation, and by any intra-abdominal diseases unrelated to pregnancy (1). The non-obstetric causes of acute abdomen in pregnant women remain the most challenging diagnostic and therapeutic dilemmas for both gynaecologists and general surgeons (1). Diagnosis and management of these diseases and the precise decision of surgery may still be difficult despite recent advancements in imaging and medical technologies (2). Difficulties in the diagnosis and management of acute abdomen in pregnant patients can result from several factors: (a) Dislocation of intraa-bdominal organs caused by an enlarged uterus. (b) Commonly encountered complaints such as nausea, vomiting, and abdominal pain among pregnant women (c) General avoidance of unnecessary surgery in pregnant women (2).

As a high-volume referral centre with the highest number of childbirths and obstetric surgeries in our country, the objectives of our study are to (a) analyse and present the cases of pregnant women with non-obstetrical causes of acute abdomen; (b) discuss the ideal diagnostic and therapeutic approaches in the light of literature; and (c) raise the awareness of non-obstetrical causes during pregnancy for gynaecologists, general surgeons and emergency medicine specialists.

Methods

We enrolled pregnant patients with non-obstetrical causes of acute abdomen requiring surgical intervention. These patients were admitted in the surgical wards from January 2013 to December 2019. We retrospectively obtained the data of pregnant women who underwent non-obstetrical surgery from the electronic hospital records and patient files, which were included in the hospital archives, polyclinic visits and phone calls.

We excluded pregnant women with obstetrical reasons for the acute abdomen (ectopic pregnancy, uterine rupture, etc.), women who were followed-up or treated conservatively and women with incomplete data from the study.

Importantly, we recorded the demographic features (age, gender), symptoms and signs at admission, imaging results, gestational age, operation time (using intra-operative anaesthesia and follow-up forms), operative results, histopathological results, laboratory findings, postoperative complications, and delivery outcomes.

The study was approved by the ethics committee of University of Health Sciences Turkey, Kanuni Sultan Süleyman Training and Research Hospital (KAEK/2020.05.28). This study was conducted according to the principles of the Helsinki Declaration. We routinely informed all the patients who provided their written consent.

All pregnant women were examined by a gynaecologist and general surgeon before surgery. Uterine contractions, foetal heart rate and movements were also routinely followed. Physical examination, ultrasonography and laboratory were employed for the diagnosis of acute appendicitis (AA). Alvarado score was calculated in every patient with suspected AA. Ultrasonography was also used for confirming pregnancy. The diagnosis of acute biliary pancreatitis (ABP) was based on the clinical examination, laboratory findings, hyperamylasemia or hyperlipasemia, and ultrasonography. Ranson score of each patient was also calculated to determine the severity of the disease. For the diagnosis of acute cholecystitis (AC), local and systemic signs of inflammation such as Murphy sign, fever, C-reactive protein, elevated leukocyte count and ultrasonography findings were used. The other causes of abdominal pain were diagnosed via physical examination, laboratory results, imaging and intra-operative findings.

Statistical Analysis

We used SPSS Windows version 15.0 statistics program (SPSS, Inc. Chicago, IL) to evaluate the data. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were expressed as percentage values and the number of patients.

Results

Among a total of 46.756 births from January 2013 to December 2019, 109 pregnant patients were recorded to be hospitalised in the surgery wards for having acute abdominal pain due to non-obstetrical causes. Of these, ABP and AC were detected in 57 patients with the diagnosis of nonspecific pain. These patients needed conservative management. Of these patients, we included 52 pregnant patients who underwent surgery due to various non-obstetrical reasons in this study (Table 1).

Because AA was the most common non-obstetrical surgical indication during the pregnancy period, special attention was focussed on the detailed data of this group of patients (35 of 52 cases). Table 2 presents the detailed data on the appendectomy cohort. In total, 35 pregnant women with the diagnosis of AA underwent surgery. The mean operation times in the open and laparoscopic approaches were 46.34±19.01 and 57±18.7 minutes, respectively. The mean hospital stay times in laparoscopic and open approaches were 3.4±1.7 and 4.5±1.6 days, respectively. Five of the laparoscopic appendectomy (LA) procedures had the requirement to be converted to be open due to various reasons such as an inability to visualise the appendix, severe adhesions, bleeding and technical insufficiency. Histopathologically proven perforated appendicitis was detected in six (17%) cases. Negative appendectomy was observed in three (9%) cases. Moreover, postoperative complications were observed in five (14%) cases as a wound infection, which was

Table 1. Non-obstetrical causes of surgery in pregnancy

Diagnosis	n	%
Acute appendicitis	35	67
Acute biliary pancreatitis	9	17
Acute cholecystitis	2	4
Rupture of ovarian cyst	2	4
Fallopian tube torsion	1	2
Intestinal obstruction	1	2
Splenic aneurysm rupture	1	2
Primary appendicitis epiploicae	1	2
Total	52	100

n: number of patients; %: percentage

treated with antibiotics and drainage. There was no foetal or maternal mortality, and also no need for intensive care unit follow-up.

In total, 63 patients with the diagnosis of ABP were treated in our surgical wards. Among them, nine pregnant patients underwent surgery because of intractability to medical treatment and readmission due to recurrent attacks. The Ranson scale was used at admission to assess the severity of ABP. Of all the patients, eight pregnant had the Ranson scores of 1 and 2 and one patient had a Ranson score of 3 (Table 3). Ultrasonography was the first diagnostic tool in all the patients. In one patient with a Ranson score of 3, computerised tomography was used to determine the severity of the disease because of the contraindication of magnetic resonance imaging (MRI). MRI is preferably used in the complicated cases of pregnancy. Of all the pregnant women, seven (78%) underwent laparoscopic cholecystectomy (two cases in the first trimester, one case in the third and four cases in the second trimester) and two (22%) cases at third trimester were started laparoscopically but were converted to open procedure. The reasons for conversion were adhesions and severe inflammation. Choledocholithiasis was detected in in two patients with high levels of cholestasis enzymes and hyperbilirubinemia via magnetic resonance cholangiopancreatography; moreover, endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy was performed in two pregnant women (Table 3). After ERCP, they underwent LC. The conservative management, namely, administration of analgesia, usage of spasmolytics and fluid replacement was started in all the pregnant women. No serious complications such as sepsis, cholangitis, infected necrosis or preterm labour were detected in any of the cases. Patients who

Table 2. Demographics, clinical laboratory and pathologic findings of patients with acute appendicitis

Parameters	n (35)	%	Mean ± SD
Age (years)	-	-	27.4±6.1
Symptoms			-
Abdominal pain	35	100	
Anorexia	28	80	
Nausea-vomiting	19	54	-
Physical examination			
RLQP	12	34	-
RLQP+rebound	17	49	-
RLQP+defense+rebound	6	17	-
Mean Alvarado score	-	-	7.6 (6-9)
Operative technique			
Laparoscopic	8	23	-
Conversion to open	5	14	-
Open	22	63	-
Pathologic results			
Normal	3	9	-
Appendicitis	26	74	-
Perforated appendicitis	6	17	-
Gestation at diagnosis			
1st trimester	10	28	-
2nd trimester	17	49	-
3rd trimester	8	23	-
Mean hospital stay (days)			
Laparoscopic	-	-	3.4±1.7
Open	-	-	4.5±1.6
WBC count (×10³/µL)	-	-	15.1±6.3
Mean operation times (minutes)			
Laparoscopic	-	-	57±18.7
Open	-	-	46.34±19.01
Appendiceal Perforation	6	17	-
Postoperative complication (SSI)	5	14	-
Required ICU	-	-	-
Preterm foetal morbidity	-	-	-

n: number of patients, SD: standard deviation, SSI: surgical site infection, ICU: intensive care unit, RLQP: right lower quadrant pain, WBC: white blood cell count

Table 3. Clinical features, treatment strategies and follow-up results of pregnant women with acute pancreatitis

Parameters	Patients n (%)
Gestational age at diagnosis	
1st trimester	2 (22)
2nd trimester	4 (44)
3rd trimester	3 (34)
Readmission	5 (56)
Ranson scale	
1	2 (22)
2	6 (67)
3	1 (11)
4	-
5	-
Revised Atlanta classification	
Mild	8 (89)
Moderate	1 (11)
Severe	-
Radiological Imaging	
US	9 (100%)
CT	-
Balthazar grade C	1 (11%)
MRCP	2 (22%)
Interventions during pregnancy	
Cholecystectomy	-
Laparoscopic	7 (78)
Open	2 (22)
ERCP + Sphincteretomy	2 (22)
Mean hospitalisation time	
Laparoscopic	2.8±1.2
Open	5.2±1.6
ICU follow-up	-
Foetal/maternal mortality	-

ERCP: endoscopic retrograde cholangiopancreatography, ICU: intensive care unit, US: ultrasonography, CT: computed tomography, MRCP: magnetic resonance cholangiopancreatography

underwent cholecystectomy were healed without any complications, and none of pregnant women were admitted to the intensive care unit. There were no foetal and maternal mortality or morbidity during the follow-up periods. Table 3 summarises the demographics, gestational ages, and clinical and diagnostic parameters.

The other causes of non-obstetrical surgery in pregnant women were AC (n=2), rupture of ovarian cyst (n=2), intestinal obstruction (n=1), isolated torsion of fallopian tube (n=1), splenic artery aneurysm (SAA) rupture (n=1) and primary appendicitis epiploicae (n=1) (Table 4). Two pregnant women with the diagnosis of AC were hospitalised and managed conservatively with bed rest, oral stoppage, administration of analgesia, fluid resuscitation and antibiotics. These patients were in the first and second trimesters, respectively. LC was decided for the treatment because of these patients' unresponsiveness to conservative treatment. These two pregnant women had no postoperative complications, and they delivered at term. Laparotomy and cystectomy were performed in two pregnant patients with ovarian cyst rupture in their first and third trimesters, respectively.

Table 4 provide a detailed description of demographic, operative, diagnostic and follow-up results of other causes.

Discussion

The term acute abdomen in pregnancy refers to any severe acute intra-abdominal condition that is accompanied by pain, tenderness and muscular rigidity. Emergency surgery should be contemplated for this condition, which may result from various obstetric and non-obstetric aetiologies. It is reported that the overall incidence of acute abdomen in pregnant women could be 1/500-635 pregnancies (3). Any gastrointestinal disorder can occur during pregnancy. The literature reports that approximately 0.5-2% of pregnant women develop an acute abdomen and thus need surgery due to non-obstetric reasons (4). Our study, unlike the literature, found a lower incidence. The number of cases requiring surgical intervention due to non-obstetric reasons in 45,654 pregnant women was 52 (0.12%).

Hizam et al. (5) published a clinical series of 91 cases requiring surgery because of non-obstetric acute abdomen. They reported the following aetiologies: AA (70.4%), AC (11%), necrotizing pancreatitis (2.2%), intestinal obstruction (2.2%) and peduncular torsion (6.6%) of ovarian cyst. Andersson et al. (6) also reported the following causes requiring surgery because of non-obstetric acute abdomen: AA, AC, ABP and intestinal obstruction. Our study had following non-obstetric acute abdominal pathologies requiring surgical intervention: AA (n=35, 67%), ABP (n=9, 17%), AC (n=2, 4%), ovarian cyst rupture (n=2, 4%), fallopian tube torsion (n=1, 2%), adhesive ileus (n=1, 2%), spleen aneurysm rupture (n=1, 2%) and primary appendicitis epiploicae (n=1, 2%).

The currently reported incidence of AA in pregnant women is 0.04% (7). AA remains one of the most common non-obstetric surgical emergencies during pregnancy (confirmed in ~1 in 1.000-2.000 pregnancies). In their series of 20 cases, Kapan et al. (8) reported that the highest incidence of AA was found in the second trimester. They reported a mean Alvarado score of 7.7 (7-9), and 50% of pregnant women were operated laparoscopically. In our study, AA (n=35) was the most common non-obstetric acute abdominal pathology that required surgical intervention. Moreover, 49% of appendicitis cases were in the second trimester, with 28% and 23% in the first and third trimesters, respectively. The mean Alvarado score of the appendicitis cases was 7.6 (range:6-9). In total, 13 (37%) patients were operated laparoscopically. In five patients, conversion from laparoscopy to open surgery was required because of insufficient exploration, severe adhesions, bleeding and technical insufficiency. The most common symptom was abdominal pain, and the most common finding was tenderness in the lower right quadrant. Histopathological results were simple appendicitis in 26 (74%) cases, perforated appendicitis in 6 (17%) cases and normal appendix in 3 (9%) cases. Postoperative complications were detected as wound infections in five cases with appendiceal perforation. Consistent with the literature, most of the pregnant women were in the third trimester. In AA, the foetal mortality rate was 5%, whereas in the case of perforation, this rate increases up to 20% and also increases the maternal mortality (7). Term delivery occurred in all the pregnant women in our study. There was no maternal or foetal mortality. Wallace et al. (9) reported an overall negative appendectomy rate of 37% for pregnant patients with presumed AA. In our study, negative appendectomy was observed in three (9%) cases.

Acute pancreatitis in pregnancy is a very rare condition with a reported rate of 1/10,000 pregnancies and most often occurs in the third trimester (10). In our study, the gestational ages of patients at diagnosis were first

Table 4. The clinical features, operative approaches and follow-up results of the other cases

Age (years)	Gestation (weeks)	Diagnosis	Operative techniques	Outcomes
21	15	Acute cholecystitis	Laparoscopic cholecystectomy	Delivery at term
27	28	Intestinal obstruction	Laparotomy-bridotomy	Preterm delivery
26	33	Spontaneous splenic artery aneurysm rupture	Emergency laparotomy-hemostasis+splenic artery aneurysm excision + splenectomy + distal pancreatectomy	Maternal and foetal mortality
24	35	Rupture of ovarian cyst	Laparotomy + cystectomy	Preterm delivery
23	34	Isolated fallopian tube torsion	Laparotomy+salpingectomy	Preterm delivery
24	9	Rupture of ovarian cyst	Laparotomy + cystectomy	Abortion
27	10	Acute cholecystitis	Laparoscopic cholecystectomy	Delivery at term
25	18	Primary appendicitis epiploicae	Laparoscopic excision	Delivery at term

trimester in two (22%), second trimester in four (44%) and third trimester in three patients (34%). Most often, it is a self-limiting disease but can progress to a more severe condition associated with multi-organ failure, shock and death. The maternal mortality rate is less than 1%, and the rate of preterm delivery is about 20% (10). In our series, maternal or foetal mortality was not observed; however, pregnancy was ended with preterm labour in two cases who underwent open cholecystectomy. The present guidelines recommend LC during the same admission in the non-pregnant patients with gallstone-induced mild to moderate ABP (11). However, the timing of LC in pregnant patients with ABP remains controversial. The currently accepted indications for surgery in ABP are obstructive jaundice, severe symptoms, signs of peritonitis and AC resistant to conservative management (12). Laparoscopic surgery has been accepted as a safe method for both mother and foetus in the second trimester (12). However, with increasing experiences in laparoscopic surgery, it has been shown that LC can be performed safely at all periods of pregnancy (13). Notably, the recurrence rate of ABP in pregnancy is significantly higher in our study. The patients were readmitted due to the recurrence of pancreatitis at a rate of 56%. This incidence reduces the quality of life of patients and increases the hospital costs. In this case, especially considering this situation, the cholecystectomy procedure can be recommended at any stage of the pregnancy. Additionally, it is crucial to highlight that preferably a laparoscopy should have been performed rather than surgery.

The optimum management of AC in pregnant women is still controversial. Traditionally, LC is usually deferred in uncomplicated cases. However, Swisher et al. (14) reported that a conservative approach is associated with higher recurrence rates in the range of 40-70%. In their decision analysis study, Jelin et al. (15) reported that there was a higher risk of foetal death (7%) among those patients who underwent conservative management than in those who underwent LC (2.2%). They concluded that LC was superior to nonoperative management during the first and second trimesters in pregnant women with gallstone disease. In our series, two pregnant patients with the diagnosis of AC underwent LC. They were at the 10th and 15th weeks of gestation, and there were no postoperative complications. Their pregnancy was ended with term delivery. We think that LC can be a safe and feasible procedure, especially in the first and second trimesters of gestation, for the treatment of AC.

Adhesive ileus in pregnancy is an extremely rare and potentially severe non-obstetric surgical entity that can be associated with a foetal loss of 17% and maternal mortality of 2% (16). According to literature, adhesive ileus occurs more commonly in the later periods of pregnancy. The occurrence rates of adhesive ileus have been reported to be 6%, 28%, 45% and 21% during the first, second, third trimesters and puerperium, respectively (17). In our series, a 27-year-old pregnant patient with a history of previous caesarean section at her third trimester was diagnosed with adhesive intestinal obstruction. At the 48th hour of her follow-up, because of the failure of conservative therapy as denoted by the symptoms of foetal distress, urgent surgical intervention with laparotomy and bridotomy through a midline incision were performed. She had no postoperative complications but underwent preterm delivery at the 36th week of gestation.

The overall risk of rupture increases with the size of the SAA, especially when it is above 2 cm. The initial presentation of SAA has been associated with acute rupture and hemodynamic instability that lead to substantial perioperative morbidity and mortality. Weakness in the arterial walls and an increase in the blood pressure may result in the development of aneurysms (18). These two conditions are known to be augmented in pregnant women. The SAA rupture usually occurs in the third trimester (19). According to the current literature, the mortality following rupture dramatically increases by up to 75% in pregnant women and is associated with a foetal mortality of 95% (20). In our series, a 26-year-old pregnant patient at the gestational age of 33 weeks was admitted in the emergency department for the conditions of hypovolemic shock and intra-abdominal haemorrhage detected in ultrasonography. An emergent laparotomy through the midline incision was performed by a general surgeon and gynaecologists. In this case, 3 litres of blood and hematoma were drained from the abdomen, splenic artery and vein were ligated with splenectomy and distal pancreatectomy to excise the aneurysm that was inseparable from the pancreatic tail. Damage control surgery was performed, and the patient was taken to the intensive care unit for hemodynamic support. But unfortunately, the patient died from multiorgan failure on the second day of the surgery. We can say that if pregnant women with abdominal pain who are at the third trimester have decreased haematocrit levels and intra-abdominal free fluid (detected by the ultrasound), then they should alert the gynaecologists and general surgeons for the possibility of intra-abdominal bleeding. The importance of close follow-up and early surgery should not be forgotten in these patients.

Primary appendicitis epiploicae is a rare clinical entity that probably results from infarction secondary to the torsion of the colonic appendage or the thrombosis of central veins of the appendage. This condition mimics the surgical acute abdomen (21). Diagnostic laparoscopy was employed in a pregnant woman with 18 weeks of gestation due to the consistent pain in lower right quadrant. Laparoscopy demonstrated appendicitis epiploicae in the ascending colon, and laparoscopic simple excision was performed in this patient. She had delivery at term.

Gurbuz and Peetz (22) reported the safety of laparoscopic technique for acute non-obstetric abdominal pathologies during pregnancy, without an additional risk to the foetus. Although it was earlier suggested that laparoscopic surgeries should be performed preferably during the second trimester, recent evidence suggests that laparoscopic surgery can be conducted during any trimester as they have very low rates of maternal and foetal morbidity (23,24). According to SAGES guidelines (25), initial access can be safely accomplished with an open or Hasson's technique in pregnant women. We had used Hasson's open technique in all the cases for an initial access. We adjusted other port locations according to the gestational age and localisation of the pathology and put it under a direct vision. The preferred insufflation pressure was kept at 8-12 mmHg because it reduces the possibility of uterine hypoperfusion and maternal pulmonary events. In our series, laparoscopic surgery had been used in 18 cases with the indications of AA (n=8), acute pancreatitis (n=7), AC (n=2), and primary appendagitis epiploicae (n=1) for both diagnostic and therapeutic purposes. There were no postoperative complications in any of the cases regarding both mother and foetus. The mean hospital

staying times were 2.8 and 3.44 days for patients who underwent LC and patient who underwent LA. Seven cases were converted to open surgery; for example, two LA and five LC procedures due to various reasons such as adhesions, severe inflammation, bleeding, the invisibility of appendix and technical insufficiency. All patients who underwent laparoscopic treatment had term labour. Therefore, according to our results, we recommend LA and LC during pregnancy if there is a need for surgery.

This study has several limitations. Because it was a retrospective study, we could not check the accuracy of the diagnosis and the maintained records. In addition, surgical techniques were entirely up to the choice of surgeons. Following the literature, laparoscopy during pregnancy is a safe and effective method in non-obstetric acute abdominal conditions requiring surgical intervention in pregnant women (26,27). The causes of non-obstetric acute abdomen during pregnancy are of great importance due to maternal and foetal mortality.

Conclusion

Acute abdomen during pregnancy can be caused by obstetric and non-obstetric diseases. These situations can sometimes result in life-threatening situations for both the mother and foetus. Laparoscopy is applicable and safe in the selected patients for the diagnosis and treatment of acute abdominal pathologies during pregnancy. Understanding anatomical and physiological changes in pregnancy, gaining sufficient information about the safe limits of radiological imaging, and a multidisciplinary systematic approach are indispensable for the timely diagnosis and treatment of pregnant women presenting with an acute abdomen.

Ethics

Ethics Committee Approval: The study was approved by the ethics committee of University of Health Sciences Turkey, Kanuni Sultan Süleyman Training and Research Hospital (KAEK/2020.05.28).

Informed Consent: All participants and their legal representatives provided written informed consent and assent.

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