



Adnexal torsion in pregnancy: A systematic review of case reports and case series

Hamidreza Didar^a, Hanieh Najafiarab^a, Amirreza Keyvanfar^b, Bahareh Hajikhani^c, Elena Ghotbi^d, Seyyedeh Neda Kazemi^{e,f,*}

^a Preventative Gynecology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^b Infectious Diseases and Tropical Medicine Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^c Department of Microbiology, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^d Department of Obstetrics and Gynecology, School of Medicine, Imam Hossein Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^e Clinical Research Development Center, Imam Hossein Educational Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

^f Department of Obstetrics and Gynecology and Female Infertility Unit, Tehran University of Medical Sciences, Tehran, Iran

ARTICLE INFO

Article history:

Received 8 November 2022

Received in revised form 16 December 2022

Accepted 18 December 2022

Keywords:

Adnexal diseases

Ovarian torsion

Ovariectomy

Pregnancy

ABSTRACT

Objectives: This study aimed to investigate clinical presentations, surgical procedures and findings, complications, and predisposing factors of adnexal torsion in pregnant women.

Methods: We searched PubMed/Medline, Embase, and Web of Science from January 2000 to March 2022. All case reports and case series with full-text English language reporting adnexal torsion in pregnant women were included. Medical history, clinical presentations, surgical procedures and findings, complications related to adnexal torsion, and predisposing factors were independently extracted by two investigators.

Results: A total of 182 articles reporting 662 pregnant women with adnexal torsion were included. Most of the adnexal torsions occurred during the first trimester (54.63%), while others occurred during the second (26.36%) and third (19.00%) trimesters. The most common symptom of adnexal torsion was sudden-onset pain (80.60%). Enlargement of the adnexa was the most prevalent ultrasound finding in a twisted adnexa (95.20%). Additionally, about half of the patients had decreased blood flow in Doppler ultrasound (53.80%). Laparoscopic surgery was the favorite option (56.88%), while cystectomy and detorsion were the most commonly performed procedure (29.06%). Expectant management was reported in only 2.99% of the patients. In addition, the most common complications were preterm labor (27.58%) and emergent cesarean sections (25.28%).

Conclusions: Clinicians should think of adnexal torsion when pregnant women complain of sudden-onset pain. Then, using ultrasound, adnexal enlargement or masses should be explored seriously. They should take invasive and urgent therapy to preserve ovaries and prevent complications.

© 2022 Elsevier Inc. All rights reserved.

1. Introduction

Adnexal torsion is an uncommon but emergent condition in pregnancy [1–3], which manifested with nonspecific symptoms. So, it can be misdiagnosed with other acute abdominal conditions such as appendicitis, renal colic, cholecystitis, intestinal obstruction, pelvic inflammatory disease, ectopic pregnancy, ruptured ovarian cysts, and non-functional ovarian cysts [4].

Pregnancy is a risk factor for adnexal torsion as well as corpus luteum cyst, ovarian hyperstimulation syndrome (OHSS), and assisted reproductive technologies (ART) [5]. Considering physiological and

anatomical alterations during pregnancy, it is challenging for clinicians to diagnose adnexal torsion in pregnant women. Early diagnosis and prompt operation are required to preserve adnexa. Moreover, abortion can be prevented by reducing ovarian edema or tissue necrosis and avoiding abdomen–pelvic inflammatory reactions [6,7]. The diagnosis of maternal adnexal torsion may be delayed in the second half of gestation because of increased dimensions of the uterus, which causes difficulties in abdominal palpation and ultrasound [8]. Factors such as bloating, limited field of view (FOV), obesity, and anatomical alterations in late pregnancy can hinder the proper visualization of adnexal regions, making exploration of adnexal torsion complex [9]. Besides, to avoid the exposure of the fetus to radiation and iodinated contrasts, the computed tomography scan (CT-scan) is used in a limited way in pregnant women. So, most pregnant women suspected of adnexal torsion underwent an ultrasound [2].

* Corresponding author at: Clinical Research Development Center, Imam Hossein Educational Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
E-mail address: s.nedakazemi@gmail.com (S.N. Kazemi).

If adnexal torsion is left untreated in pregnant women, it may lead to maternal morbidity, future infertility, and fetal complications [1]. In early pregnancy, oophorectomy for removing the ovary containing the corpus luteum may lead to miscarriage. Hence, clinicians should consider expectant management when facing adnexal torsion, especially in young women with early pregnancy [10]. However, expectant management through detorsion develops the risk of ovarian torsion recurrence, which requires long-term follow-up [11].

This study was performed to answer the following questions: “What are the most common presenting symptoms and ultrasound findings of adnexal torsion in pregnancy?”; “What surgical approaches are typically utilized for adnexal torsion in pregnancy?”; “What intraoperative pathologies are commonly found in case of adnexal torsion in pregnancy?”; “What are the most common predisposing factors of adnexal torsion in pregnancy?”

2. Methods

In this study, we followed the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses” (PRISMA) statement [12].

2.1. Literature search and study selection

We searched PubMed/Medline, Embase, and Web of science to identify relevant studies published from January 2000 to March 2022. We used this query as the search strategy: (((Adnexal torsion) OR (tubo-ovarian torsion)) OR (ovarian torsion)) AND (pregnancy). Two reviewers independently screened the publications. We included case reports and case series with full-text English language reporting

adnexal torsion in pregnant women. We did not include published conference and professional society practical guidelines. Duplicate publications, articles with no relevant data, and reviews or meta-analyses were excluded.

2.2. Data extraction

Two reviewers extracted the following data from the full texts of eligible publications: the first author's name, date of publication, country, the total number of women with torsion, the total number of pregnant women with torsion, medical history, clinical presentations (symptoms, signs, laboratory results and ultrasound findings), surgical procedures and findings (type of surgery, type of torsion, intra-operative visualization, and histopathology), complications related to adnexal torsion, and predisposing factors. During the review process, the reviewers resolved disagreements with a third individual from the research team.

3. Results

3.1. Study selection

The literature search revealed 1507 records initially. After removing duplicate publications, the titles and abstracts of 942 papers were screened. After applying the exclusion criteria to the full-text documents, 182 articles (142 case reports and 40 case series) with a total number of 662 pregnant patients with adnexal torsion met the inclusion criteria (Fig. 1). Table 1 presents the characteristics of included studies.

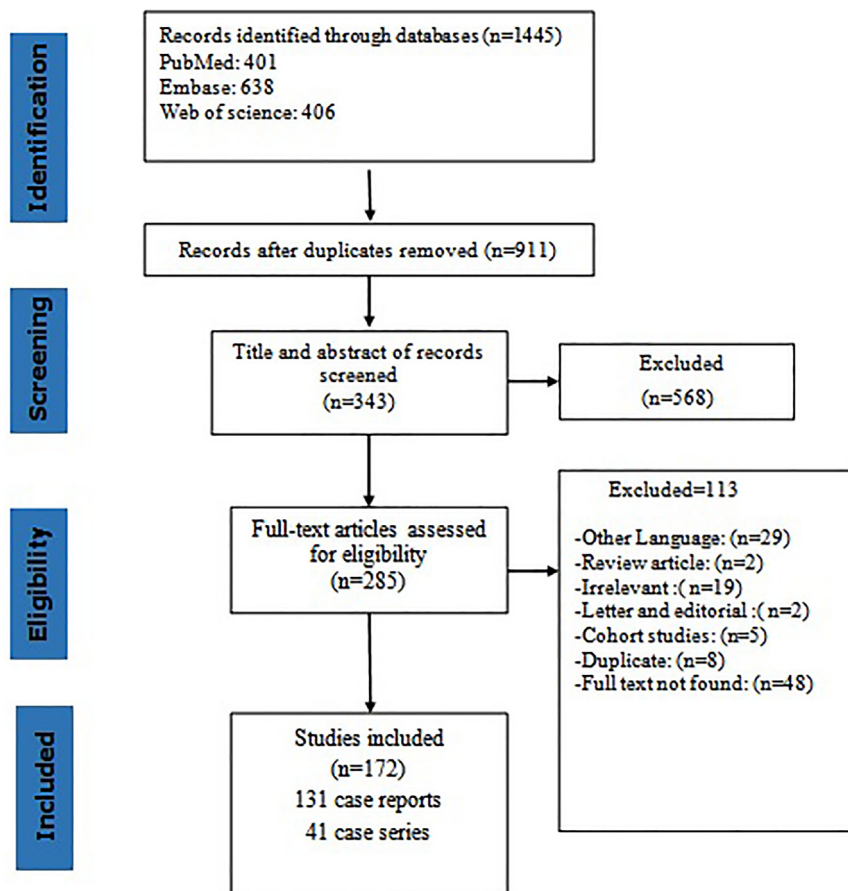


Fig. 1. Flow chart of study selection for inclusion in the systematic review.

Table 1
Characteristics of case reports/ case series.

References	Country	Published time	No. of women with ovarian torsion	No. of pregnant women with ovarian torsion	Age of pregnant women with ovarian torsion
Houry et al. [23]	USA	2000	87	12	NA
Chew et al. [24]	Singapore	2001	1	1	38
Abu-Musa et al. [25]	Lebanon	2001	1	1	26
Pinto et al. [26]	USA	2001	1	1	39
Phupong et al. [27]	Thailand	2001	1	1	34
Yaman et al. [28]	Austria	2002	1	1	32
Römer et al. [29]	Germany	2002	1	1	26
Gorkemli et al. [30]	Belgium	2002	9	6	32
Buser et al. [31]	USA	2002	1	1	22
Haenggi et al. [32]	Switzerland	2003	1	1	30
Huang et al. [33]	Taiwan	2003	1	1	35
Phupong et al. [34]	Thailand	2003	1	1	25
Romano et al. [35]	Israel	2003	1	1	27
Mathevet et al. [36]	France	2003	5	5	NA
Born et al. [37]	Germany	2004	1	1	22
Djavadian et al. [38]	Germany	2004	2	2	29
Pan et al. [39]	Taiwan	2004	1	1	35
Baksu et al. [40]	Turkey	2004	1	1	26
Vijayaraghavan et al. [41]	India	2004	21	1	NA
Roman et al. [42]	France	2005	1	1	26
Kumari et al. [43]	India	2005	5	5	NA
WU et al. [44]	Taiwan	2005	1	1	19
Oto et al. [45]	USA	2005	3	3	23.3
Djakovic et al. [46]	Germany	2006	1	1	26
Birchard et al. [47]	USA	2006	1	1	30
Rackow et al. [48]	USA	2007	2	2	28
Cornfeld et al. [49]	USA	2007	2	2	28.5
Upadhyay et al. [50]	USA	2007	2	2	33.9
Palanivelu et al. [51]	India	2007	1	1	30
Zanforlin Filho et al. [52]	Brazil	2008	1	1	29
Grgic et al. [53]	Croatia	2008	1	1	34
Renjit et al. [54]	Oman	2008	1	1	26
Rauf et al. [55]	UK	2008	1	1	22
Weitzman et al. [56]	USA	2008	2	2	32
DiLuigi et al. [57]	USA	2008	1	1	23
Silja et al. [58]	Oman	2008	1	1	32
Singh et al. [59]	India	2008	1	1	28
Wasik et al. [60]	UK	2008	1	1	29
Hasiakos et al. [4]	Greece	2008	4	4	30.25
Prefumo et al. [61]	Italy	2009	1	1	31
Christopoulos et al. [62]	Greece	2009	1	1	35
Varghese et al. [63]	Oman	2009	1	1	26
Arena et al. [64]	Italy	2009	1	1	38
Pezzuto et al. [65]	Italy	2009	1	1	33
Kolluru et al. [66]	India	2009	1	1	23
Eftekhar et al. [67]	Iran	2009	1	1	30
Oto et al. [2]	USA	2009	3	3	NA
Katz et al. [68]	Israel	2009	3	3	NA
Giulini et al. [69]	Italy	2010	1	1	31
Boswell et al. [70]	USA	2010	1	1	33
Ramesh et al. [71]	India	2010	1	1	29
Kayabasoglu et al. [72]	Turkey	2010	1	1	38
Efthimiadis et al. [73]	Greece	2010	1	1	NA
Chang et al. [74]	South Korea	2010	8	8	31.5
Terzić et al. [75]	Serbia	2011	1	1	31
Ten Cate et al. [76]	Belgium	2011	1	1	33
Simsek et al. [77]	Turkey	2011	1	1	27
Choudhary et al. [78]	India	2011	1	1	38
Shirokane et al. [79]	Japan	2011	1	1	37
Chohan et al. [80]	USA	2011	1	1	33
Al Omari et al. [81]	UAE	2011	2	2	30
Kibbey et al. [82]	Australia	2011	1	1	28
Uchil et al. [83]	UK	2011	1	1	21
Ergenoglu et al. [84]	Turkey	2011	1	1	30
Koo et al. [85]	South Korea	2011	55	55	30.8
Akl et al. [86]	USA	2012	1	1	32
Spitzer et al. [87]	Austria	2012	5	5	32.8
Ali et al. [3]	Egypt	2012	1	1	23
Passarinho et al. [88]	Portugal	2012	1	1	32
Shakir F [89]	UK	2012	1	1	37
Duncan et al. [90]	Australia	2012	1	1	28
Tsai et al. [91]	Taiwan	2012	1	1	32
Gaspar-Oishi et al. [92]	USA	2012	1	1	30

(continued on next page)

Table 1 (continued)

References	Country	Published time	No. of women with ovarian torsion	No. of pregnant women with ovarian torsion	Age of pregnant women with ovarian torsion
Behar et al. [93]	Brazil	2012	1	1	20
Tsafir et al. [94]	Israel	2012	216	48	NA
Lazaridis et al. [95]	UK	2013	1	1	39
Kaido et al. [96]	Japan	2013	1	1	30
Tsai et al. [97]	Taiwan	2013	3	3	33
Morton et al. [98]	USA	2013	1	1	30
Dursun et al. [99]	Turkey	2013	1	1	NA
Munshi et al. [100]	India	2013	1	1	26
Frederick et al. [101]	Jamaica	2013	1	1	32
Maurice et al. [102]	USA	2013	1	1	28
Pérez-Rodríguez et al. [103]	Puerto Rico	2013	1	1	27
Sidiropoulou et al. [104]	Portugal	2014	1	1	36
Chandrasekar et al. [105]	UK	2014	1	1	33
Büke et al. [106]	Turkey	2014	1	1	26
El-Agwany et al. [107]	Egypt	2014	1	1	26
Bakacak et al. [108]	Turkey	2014	1	1	18
Yildirim et al. [109]	Turkey	2014	1	1	25
Sun et al. [110]	China	2014	1	1	32
Aydin et al. [111]	Turkey	2014	1	1	28
Tan et al. [112]	Taiwan	2014	1	1	28
Al-Badawi et al. [113]	Saudi Arabia	2014	2	2	34.5
Feng et al. [114]	China	2014	1	1	26
Priyadharisini et al. [115]	India	2014	1	1	22
Abdullah Agha et al. [116]	UK	2014	1	1	23
Graziano et al. [117]	Italy	2014	1	1	28
Kaur et al. [118]	UK	2014	1	1	28
Surampudi et al. [119]	India	2014	18	18	NA
Takeda et al. [120]	Japan	2014	3	3	NA
Ekin et al. [121]	Turkey	2015	1	1	26
Kim et al. [122]	South Korea	2015	1	1	29
Polat et al. [123]	Turkey	2015	1	1	36
Mathew et al. [124]	Oman	2015	1	1	22
Lee et al. [125]	South Korea	2015	1	1	35
Rouzi et al. [126]	Saudi Arabia	2015	1	1	29
Li et al. [127]	China	2015	1	1	27
Smolinski et al. [128]	USA	2015	1	1	28
Özler et al. [129]	Turkey	2015	1	1	18
Williams et al. [130]	UK	2015	1	1	36
Iyswaria et al. [131]	India	2015	1	1	25
Kim et al. [132]	Korea	2015	1	1	35
Basaranoglu et al. [133]	Turkey	2015	132	24	29
Habek et al. [134]	Croatia	2016	1	1	32
Petresin et al. [135]	Germany	2016	1	1	33
Lai et al. [136]	China	2016	1	1	26
Kahramanoglu et al. [137]	Turkey	2016	1	1	32
Özlu et al. [138]	Turkey	2016	1	1	25
Wyckoff et al. [139]	USA	2016	1	1	20
Ding et al. [140]	Taiwan	2016	1	1	17
Kim et al. [141]	South Korea	2016	1	1	35
Warda et al. [142]	USA	2016	1	1	37
Gobara et al. [143]	Japan	2016	1	1	24
Koumoutsea et al. [144]	UK	2016	1	1	33
Ramirez et al. [145]	USA	2016	1	1	27
Ganesh et al. [146]	India	2016	1	1	23
Güraslan et al. [147]	Turkey	2016	1	1	30
Karataş et al. [148]	Turkey	2016	1	1	27
Vaswani et al. [149]	India	2016	1	1	31
Minig et al. [150]	Spain	2016	4	4	30.75
Bras et al. [151]	Portugal	2017	1	1	27
Kaur et al. [152]	India	2017	1	1	24
Prabhu et al. [153]	India	2017	1	1	19
Young et al. [1]	USA	2017	1	1	34
Bouquet et al. [154]	Switzerland	2017	1	1	27
Navarro et al. [155]	Spain	2017	1	1	30
Kunovsky et al. [156]	Czech Republic	2017	1	1	35
Nasiri et al. [157]	USA	2017	1	1	31
Guterman et al. [158]	France	2017	4	4	35.5
Asch et al. [159]	USA	2017	6	6	NA
Hosny et al. [160]	Egypt	2017	7	4	NA
Ferrari et al. [7]	Italy	2018	1	1	34
Shore et al. [161]	Canada	2018	1	1	37
Jones et al. [162]	UK	2018	1	1	38
Al Salmi et al. [163]	Canada	2018	2	2	33.5
Li et al. [6]	China	2018	1	1	36
Soundararajan et al. [164]	India	2018	3	3	NA
Tankou et al. [165]	USA	2018	60	9	NA

Table 1 (continued)

References	Country	Published time	No. of women with ovarian torsion	No. of pregnant women with ovarian torsion	Age of pregnant women with ovarian torsion
Tanaka et al. [166]	Japan	2019	1	1	33
Levin et al. [167]	Israel	2019	1	1	28
Khalife et al. [168]	Lebanon	2019	1	1	31
Park et al. [169]	S. Korea	2019	1	1	36
Halimeh et al. [170]	Lebanon	2019	1	1	32
Kanayama et al. [11]	Japan	2019	1	1	40
Uyanikoglu et al. [171]	Turkey	2019	1	1	37
Hua et al. [172]	China	2019	1	1	25
Guenoun et al. [173]	Morocco	2019	3	3	22
Chavan et al. [174]	India	2019	7	7	NA
Yu et al. [175]	China	2019	5	5	NA
Buțureanu et al. [176]	Romania	2019	6	6	NA
Wang et al. [22]	China	2019	174	143	NA
Sun et al. [177]	China	2019	17	17	28.5
Camelia et al. [178]	Romania	2020	3	3	NA
Yildirim et al. [179]	Turkey	2020	1	1	28
Bai et al. [9]	China	2020	1	1	27
Bacalbaşa et al. [180]	Romania	2020	1	1	27
Takeda et al. [181]	Japan	2020	1	1	30
Conte et al. [182]	Morocco	2020	2	2	28.5
Cagle-Colon et al. [183]	USA	2020	1	1	21
Hacıoğlu et al. [184]	Turkey	2020	1	1	40
Wang et al. [185]	China	2020	82	82	28
Rasekhjehromi et al. [186]	Iran	2020	1	1	28
Bernigaud et al. [187]	France	2021	1	1	34
Osto et al. [188]	USA	2021	1	1	22
Thomas et al. [189]	USA	2021	1	1	27
Ijarotimi et al. [190]	Nigeria	2021	1	1	29
Harou et al. [191]	Morocco	2021	1	1	40
Getaneh et al. [192]	USA	2021	1	1	28
Elbaum et al. [193]	USA	2021	1	1	26
Yu et al. [194]	China	2021	1	1	32
Lee et al. [195]	South Korea	2022	1	1	35

NA = not available.

3.2. Medical history of the patients

Most of the adnexal torsions in pregnancy occurred during the first trimester (230/421, 54.63%); others occurred during the second (111/421, 26.36%) and third (80/421, 19.00%) trimesters. Also, the data of the remaining 241 patients were not reported. Regarding past obstetrical history, available data was limited: 10 cases had a previous natural vaginal delivery (10/101, 9.90%), 21 patients had a history of cesarean section (21/244, 8.60%), and the remainder of the studies reported no obstetrical history. Also, 28 women underwent abdominal surgeries other than cesarean section (28/103, 27.18%).

3.3. Clinical presentations of the patients

Table 2 shows the clinical presentations of the patients. The most common location of pain was the right lower quadrant (RLQ) (97/194, 50.0%), followed by the left lower quadrant (LLQ) (42/194, 21.64%), hypogastric (36/194, 18.55%), and generalized pain (13/194, 6.70%). The most prevalent quality of the pain was sudden onset (173/212, 81.60%), followed by constant (25/212, 11.79%), sharp (23/212, 10.84%), radiating (13/212, 6.70%), and colicky (1/212, 0.51%). On physical examination, the most common finding was local abdominal tenderness (127/195, 65.12%), followed by generalized abdominal tenderness (13/195, 6.66%).

Normal white blood cell (49/72, 68.05%) was more common than leukocytosis (23/72, 31.94%). Most cases had normal hemoglobin (32/42, 76.19%), while some had anemia (9/42, 21.42%).

The most common ultrasound findings were adnexal enlargement (101/106, 95.2%) and decreased blood flow (97/180, 53.8%). Also, 86 patients reported simple ovarian cysts (86/116, 74.1%), and 46 reported complex ovarian cysts (46/102, 45.1%). Among studies indicating the size of the cyst, cysts < 8 cm (32/56, 57.14%) were more prevalent than cysts ≥ 8 cm (24/56, 42.85%).

3.4. Surgical procedures and findings

In this systematic review, adnexal torsion was approved in most cases (644/662) by surgical visualization, and the remaining cases (18/662) were diagnosed by ultrasound findings. Table 3 depicts surgical procedures and findings of the patients. In general, 163 studies mentioned how to treat pregnant women with adnexal torsion. Laparoscopic surgery (190/334, 56.88%) was more than open surgery (134/334, 40.11%) or expectant management (10/334, 2.99%). Additionally, 169 studies reported the exact procedures. The most common procedure was cystectomy and detorsion (100/344, 29.06%), followed by salpingo-oophorectomy (94/344, 27.32%) and solitary detorsion (63/344, 18.31%). Salpingectomy, oophorectomy, cystectomy, ovariopexy, and combination therapy (e.g., detorsion and ligament plication, cystectomy and ovariopexy, and others) were less common.

In studies reporting more detailed intra-operative findings, adnexal torsion was more prevalent on the right side (219/346, 63.29%) than on the left side (126/346, 36.41%) or bilateral (1/346, 0.28%). Overall, 214 patients had a net diagnosis of the type of torsion through surgery as follows: 77 adnexal torsions (including torsion of the ovary and fallopian tube) (35.98%), 73 isolated ovarian torsions (34.11%), 33 solitary cyst torsions (15.42%), and 28 isolated tubal torsions (13.08%).

Based on histopathology, the most common findings were corpus luteum (54/204, 26.47%), dermoid cyst (47/204, 23.03%), serous cyst adenoma (30/204, 14.70%), simple cyst (27/204, 13.23%), and hemorrhagic or necrotic ovary (25/204, 12.25%).

3.5. Complications related to adnexal torsion

Forty-four studies reported at least one complication related to adnexal torsion. Among 87 complications, preterm labor (24/87, 27.58%) was on top of the list, followed by emergent cesarean section (C/S)

Table 2
Clinical presentations of the patients.

Variables	Number of studies	n/N* (%)
Symptoms		
Quality of pain		
Sudden onset	98	173/212 (81.60)
Constant	98	25/212 (11.79)
Sharp	98	23/212 (10.84)
Radiating	98	16/212 (7.54)
Colicky	98	12/212 (5.66)
Location of pain		
RLQ	141	97/194 (50.0)
LLQ	141	42/194 (21.64)
Hypogastric	141	36/194(18.55)
Generalized	141	13/194 (6.70)
RUQ or LUQ	141	1/194 (0.51)
Other symptoms		
Nausea	86	151/218 (69.26)
Vomiting	73	75/94 (79.78)
Fever	79	10/161 (6.21)
Exam findings		
Local abdominal tenderness	109	127/195 (65.12)
Generalized Abdominal tenderness	109	13/195 (6.66)
No tenderness	109	2/195 (1.02)
Laboratory findings		
Normal WBC	67	49/72 (68.05)
Leukocytosis	67	23/72 (31.94)
Anemia	42	9/42 (21.42)
Normal hemoglobin	42	32/42 (76.19)
Elevated hemoglobin	42	1/72 (1.38)
Elevated CRP	25	19/29 (65.51)
Ultrasound findings		
Adnexal enlargement	62	101/106 (95.2)
Decreased blood flow	74	97/180 (53.8)
Simple ovarian cyst	28	86/116 (74.1)
Complex ovarian cyst	19	46/102 (45.1)
Cysts <8 cm	48	32/56 (57.14)
Cyst ≥8 cm	48	24/56 (42.85)
Ovarian superficiality	6	6/22 (27.27)
Ovarian edema	10	10/11 (91.0)
OHSS	14	15/16 (93.75)
EP	3	3/3 (100)
Increased vascularity in the ovary	2	2/2 (100)
Paratubal Cyst	4	4/5 (80.0)
Normal	6	6/6 (100)

n, the number of patients with each variable; N, the total number of studied patients; EP, Ectopic pregnancy; LLQ, Left lower quadrant; LUQ, Left upper quadrant; OHSS, Ovarian hyperstimulation syndrome; RLQ, Right lower quadrant; RUQ, Right upper quadrant; WBC, White blood cell.

Leukocytosis is defined as $WBC \geq 13.6 \times 10^3/L$ for the first trimester, $\geq 14.8 \times 10^3/L$ for the second trimester, and $\geq 16.9 \times 10^3/L$ for the third trimester. Normal hemoglobin is defined as hemoglobin 11.6–13.9 mg/dL for the first trimester, 9.7–14.8 mg/dL for the second trimester, and 9.5–15.0 mg/dL for the third trimester [196].

(22/87, 25.28%) and miscarriage/abortion (14/87, 16.09%). Other complications were reported in a few cases (Table 4).

3.6. Predisposing factors for adnexal torsion

Finally, we showed predisposing factors for adnexal torsion in Table 5. The most common predisposing factor for adnexal torsion was follicular/luteal cysts (133/495, 26.86%), followed by ART (132/495, 26.66%), ovarian complex cyst -dermoid cyst, serous cyst adenoma, and mucinous cyst adenoma- (98/495, 19.79%), OHSS (36/495, 7.27%), and paratubal cyst (28/495, 5.65%). Interestingly, few patients had no predisposing factor (19/495, 3.83%).

4. Discussion

Adnexal torsion is the fifth gynecologic emergency. Despite its rarity in pregnancy, the difficulties in diagnosis, treatment, and complications make it a tough challenge for clinicians [5].

Patients almost describe a sudden onset of sharp pain in addition to nausea and vomiting. On physical examination, the most common sign

Table 3
Surgical procedures and findings.

Variables	Number of studies	n/N* (%)
Type of surgery		
Laparoscopic surgery	163	190/334 (56.88)
Open surgery	163	134/334 (40.11)
Expectant management	163	10/334 (2.99)
Cystectomy and detorsion	169	100/344 (29.06)
Salpingo-oophorectomy	169	94/344 (27.32)
Salitary detorsion	169	63/344 (18.31)
Salpingectomy	169	24/344 (6.97)
Oophorectomy	169	24/344 (6.97)
Cystectomy	169	21/344 (6.10)
Ovariopexy	169	11/344 (3.19)
Combination therapy	169	7/344 (2.03)
Type of torsion		
Right side	159	219/346 (63.29)
Left side	159	126/346 (36.41)
Bilateral	159	1/346 (0.28)
Adnexal torsion	156	77/214 (35.98)
Isolated ovarian torsion	156	73/214 (34.11)
Solitary cyst torsion	159	33/214 (15.42)
Isolated tubal torsion	156	28/214 (13.08)
Pedunculated leiomyoma	156	2/214 (0.93)
Isolated infundibular torsion	156	1/214 (0.46)
Intra-operative visualization & histopathology		
Corpus luteum	93	54/204 (26.47)
Dermoid cyst	93	47/204 (23.03)
Serous cyst adenoma	93	30/204 (14.70)
Simple cyst	93	27/204 (13.23)
Hemorrhagic or necrotic ovary	93	25/204 (12.25)
Malignant mass	93	6/204 (2.94)
Ectopic pregnancy	93	5/204 (2.45)
Mucinous adenoma	93	4/204 (1.96)
Endometriosis	93	4/204 (1.96)
Ovarian leiomyoma	93	2/204 (0.98)

n, the number of patients with any variables; N, the total number of procedures OHSS: Ovarian hyperstimulation syndrome.

Table 4
Complications related to adnexal torsion.

Variables	Number of studies	n/N (%)
Preterm labor	44	24/87 (27.58)
Emergent C/S	44	22/87 (25.28)
Miscarriage/abortion	44	14/87 (16.09)
Fetal/newborn complications	44	7/87 (8.04)
Recurrence	44	6/87 (6.89)
Preeclampsia	44	6/87 (6.89)
Others*	44	8/87 (9.19)

n, the number of patients with each variable; N, the total number of patients with complications; C/S, cesarean-section.

* internal bleeding/hemoperitoneum (due to the cyst rupture), small bowel obstruction, ileus, premature rupture of membrane (PROM), and hydronephrosis.

Table 5
Predisposing factors for adnexal torsion.

Variables	Number of studies	n/N* (%)
Follicular/Luteal cysts	169	133/495(26.86)
ART	169	132/495 (26.66)
Complex ovarian cyst	169	98/495 (19.79)
OHSS	169	36/495 (7.27)
Paratubal cyst	169	28/495 (5.65)
PCOS	169	15/495 (3.03)
Ovarian neoplasm	169	8/495 (1.61)
Ectopic pregnancy	169	7/495 (1.41)
Large ovary	169	6/495 (1.21)
Endometriosis	169	5/495 (1.01)
Elongation of adnexa	169	4/495 (0.80)
Hydrosalpinx/hematosalpinx	169	4/495 (0.80)

n, the number of patients with each variable; N, the total number of predisposing factors; OHSS, Ovarian hyperstimulation syndrome; PCOS, polycystic ovarian syndrome.

is local tenderness. However, a few patients are febrile. These findings indicate an ischemic process due to a partial or complete rotation of adnexa. Since the process is acute, considerable changes in routine laboratory tests are uncommon. In contrast, the CRP level was elevated in our study, which is generally higher in pregnant women than in non-pregnants [13].

Ultrasound is an applicable device for investigating the adnexa. Because of a gravid uterus and anatomical alterations in pregnancy, it has no maximum efficacy [14]. Definite diagnosis of adnexal is made by surgical visualization [15]. However, it is recommended to perform ultrasound imaging due to the harmlessness and helpfulness. In a pregnant woman with adnexal torsion, the most common finding in ultrasound is adnexal enlargement with or without a viable mass. According to the literature, 80% of adnexal torsions are associated with masses >5 cm [14]. Our findings revealed a little increased chance of torsion in cysts larger than 8 cm. Although a normal ultrasound is rare in the case of torsion, it cannot rule out adnexal torsion [14]. Also, decreased blood flow of the ovarian artery using the color Doppler method should consider an alarm for adnexal torsion. However, normal color Doppler findings will not rule it out [16].

Appendicitis is on top of the differential diagnoses of adnexal torsion. Appendicitis generally manifested with RLQ pain (the most common site of pain in our study) and local tenderness, accompanied by nausea and vomiting. Due to the similar clinical manifestations and imaging limitations in pregnant women mentioned above, adnexal torsion can be misdiagnosed with appendicitis. However, the mechanism of pain in torsion is ischemia, while the infection is the leading cause of appendicitis [17]. In our study, about one-third of the patients had leukocytosis. Leukocytosis strongly predicts appendicitis, chorioamnionitis, and other infectious pregnancy complications. But, physicians should remember that adnexal torsion may also present with leukocytosis. Additionally, the presence of fever can help clinicians to distinguish between adnexal torsion and infection. Adnexal torsion is rarely accompanied by fever [17], as most of our cases were afebrile.

Consistent with the literature, about two-thirds of the adnexal torsion occurs on the right side [18]. Because the right utero-ovarian ligament is longer than the left and the left sigmoid colon physically limits left ovary movement, the torsion on the right side is more common. Most torsion events happen in the first trimester of pregnancy, probably by the impact of predisposing factors such as ART and Cysts (follicular or luteal cysts). However, the third trimester has the lowest incidents, probably due to the enlargement uterine, followed by the limitation of adnexa space for torsion. Also, during the third trimester, there is no luteal cyst nor ART effect to cause the adnexal torsion [18].

The most common finding on the histopathology was a functional cyst, including follicular and luteal cysts. It is explainable by the cyst formation during the stimulation of ovaries by ART [19]. Our study's second pathology finding was dermoid cysts, contributing to 23% of all torsions in pregnant women. Dermoid cysts are the most common masses associated with torsion in non-pregnant women [20].

A population-based cohort study compared the surgical techniques and outcomes of 1366 pregnant women with torsion with non-pregnant women with torsion. The most predominant treatment was open surgery (57%), followed by expectant management (17%). The study mentioned that the laparoscopic technique (15%) was less common than in previous studies [21]. However, in our review, laparoscopy had a higher rate with 56.88%, followed by laparotomy (40.11%). Expectant management only accounted for 2.99%. At first glance, an open surgery rate of 40.11% may seem very high for this condition. In this systematic study, case reports from the year 2000 to now have been considered. The rate of laparotomy may be skewed by time since laparoscopic surgery was less common in the past. Besides, some cases presented initially with acute abdomen. It was unavoidable to perform laparotomy in these cases. In a retrospective study conducted in China, a higher proportion of non-pregnant women with torsion underwent expectant management than pregnant women with torsion (5%

vs. 19%). So, it can be hypothesized that adnexal torsion in pregnancy requires more invasive and urgent therapies [22]. Most procedures in our studies were cystectomy and detorsion (29.06%), followed by salpingo-oophorectomy (27.32%). However, in a previous study, salpingo-oophorectomy amounted to 52% of all procedures. This difference can be attributed to the developments in surgical procedures and scientific advances. Traditionally, thromboembolism after detorsion of the adnexa and the higher recurrence rate encouraged surgeons to remove the adnexa [21]. However, we report no thromboembolic event, and only 6 cases relapsed.

We may assume that some relevant articles are unintentionally excluded despite searching multiple databases with proper queries. Also, we included published articles written in English, so there is a possible issue of language bias. Also, we only included case series and case reports. Other types of studies, published conferences, and professional society practical guidelines were not involved in our review.

5. Conclusions

When pregnant women present with sudden-onset pain (mainly on the RLQ), local tenderness, nausea, and vomiting, clinicians should think of adnexal torsion, especially in the lack of fever. Then, using ultrasound, adnexal enlargement or masses should be explored seriously. They should take invasive and urgent therapy to preserve ovaries and prevent complications.

Funding

This study received no financial support.

CRediT authorship contribution statement

Hamidreza Didar: Data curation, Conceptualization, Writing - original draft. **Hanieh Najafarab:** Data curation, Writing - review & editing. **Amirreza Keyvanfar:** Writing - review & editing, Methodology, Formal analysis. **Bahareh Hajikhani:** Methodology, Formal analysis. **Elena Ghotbi:** Investigation, Data curation. **Seyyedeh Neda Kazemi:** Supervision, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

We thank the Preventative Gynecology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran, for their excellent collaboration.

References

- [1] Young R, Cork K. Intermittent ovarian Torsion in pregnancy. *Clin Pract Cases Emerg Med.* 2017;1(2):108–10.
- [2] Oto A, Ernst RD, Ghulmiyyah LM, Nishino TK, Hughes D, Chaljub G, et al. MR imaging in the triage of pregnant patients with acute abdominal and pelvic pain. *Abdom Imaging.* 2009;34(2):243–50.
- [3] Ali MK, Abdelbadee AY, Shazly SA, Abbas AM. Adnexal torsion in the first trimester of pregnancy: A case report. *Middle East Fertil Soc J.* 2013;18(4):284–6.
- [4] Hasiakos D, Papakonstantinou K, Kontoravidis A, Gogas L, Aravantinos L, Vitoratos N. Adnexal torsion during pregnancy: report of four cases and review of the literature. *J Obstet Gynaecol Res.* 2008;34(4 Pt 2):683–7.
- [5] Yuk JS, Shin JY, Park WI, Kim DW, Shin JW, Lee JH. Association between pregnancy and adnexal torsion: A population-based, matched case-control study. *Medicine.* 2016;95(24):e3861.
- [6] Li C, Wang S, Tao X, Hu Y, Li X, Xiao X. Torsion of normal-sized ovary during late pregnancy: A case report and review of the literature. *J Obstet Gynaecol Res.* 2018;44(11):2110–4.
- [7] Ferrari F, Tisi G, Forte S, Sartori E, Odicino F. Adnexal torsion with normal ovary in the third trimester of a twin pregnancy: case report and literature review. *J Obstet Gynaecol Res.* 2019;45(1):226–9.

- [8] Chang SD, Yen CF, Lo LM, Lee CL, Liang CC. Surgical intervention for maternal ovarian torsion in pregnancy. *Taiwan J Obstet Gynecol*. 2011;50(4):458–62.
- [9] Bai W, Xu X, Xie H, Sun C, Che K, Liu M, et al. Adnexal torsion in the third trimester of pregnancy: a case report and diagnostic value of MR imaging. *BMC Med Imaging*. 2020;20(1):19.
- [10] Mathew M, Mubarak SA, Jesrani SK. Conservative management of twisted ischemic adnexa in early pregnancy. *Ann Med Health Sci Res*. 2015;5(2):142–4.
- [11] Kanayama S, Kaniwa H, Tomimoto M, Zhang B, Nishioka K, Oi H. Laparoscopic detorsion of the ovary in ovarian hyperstimulation syndrome during the sixth week of gestation: A case report and review. *Int J Surg Case Rep*. 2019;59:50–3.
- [12] Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264–9. w64.
- [13] Watts DH, Krohn MA, Wener MH, Eschenbach DA. C-reactive protein in normal pregnancy. *Obstet Gynecol*. 1991;77(2):176–80.
- [14] Dawood MT, Naik M, Bharwani N, Suddehuddin SA, Rockall AG, Stewart VR. Adnexal Torsion: review of radiologic appearances. *Radiographics: Rev Publ Radiol Soc N Am Inc*. 2021;41(2):609–24.
- [15] Guile SL, Mathai JK. Ovarian torsion. *StatPearls*. Treasure Island (FL): StatPearls Publishing copyright © 2022. StatPearls Publishing LLC; 2022..
- [16] Grunau GL, Harris A, Buckley J, Todd NJ. Diagnosis of ovarian Torsion: is it time to forget about Doppler? *J Obstet Gynaecol Can*. 2018;40(7):871–5.
- [17] Yilmaz HG, Akgun Y, Bac B, Celik Y. Acute appendicitis in pregnancy—risk factors associated with principal outcomes: a case control study. *Int J Surg (London, England)*. 2007;5(3):192–7.
- [18] Huchon C, Fauconnier A. Adnexal torsion: a literature review. *Eur J Obstet Gynecol Reprod Biol*. 2010;150(1):8–12.
- [19] Qublan HS, Amarin Z, Tahat YA, Smadi AZ, Kilani M. Ovarian cyst formation following GnRH agonist administration in IVF cycles: incidence and impact. *Hum Reprod*. 2006;21(3):640–4.
- [20] Chang HC, Bhatt S, Dogra VS. Pearls and pitfalls in diagnosis of ovarian torsion. *Radiographics: Rev Publ Radiol Soc N Am Inc*. 2008;28(5):1355–68.
- [21] Bassi A, Czuzoj-Shulman N, Abenhaim HA. Effect of pregnancy on the management and outcomes of ovarian Torsion: A population-based matched cohort study. *J Minim Invasive Gynecol*. 2018;25(7):1260–5.
- [22] Wang Z, Zhang D, Zhang H, Guo X, Zheng J, Xie H. Characteristics of the patients with adnexal torsion and outcomes of different surgical procedures: A retrospective study. *Medicine*. 2019;98(5):e14321.
- [23] Houry D, Abbott JT. Ovarian torsion: a fifteen-year review. *Ann Emerg Med*. 2001;38(2):156–9.
- [24] Chew S, Ng SC. Laparoscopic treatment of a twisted hyperstimulated ovary after IVF. *Singap Med J*. 2001;42(5):228–9.
- [25] Abu-Musa A, Nassar A, Usta I, Khalil A, Hussein M. Laparoscopic unwinding and cystectomy of twisted dermoid cyst during second trimester of pregnancy. *J Am Assoc Gynecol Laparosc*. 2001;8(3):456–60.
- [26] Pinto AB, Ratts VS, Williams DB, Keller SL, Odem RR. Reduction of ovarian torsion 1 week after embryo transfer in a patient with bilateral hyperstimulated ovaries. *Fertil Steril*. 2001;76(2):403–6.
- [27] Phupong V, Intharasakda P. Twisted fallopian tube in pregnancy: a case report. *BMC Pregnancy Childbirth*. 2001;1(1):5.
- [28] Yaman C, Ebner T, Jesacher K. Three-dimensional power Doppler in the diagnosis of ovarian torsion. *Ultrasound Obstet Gynecol*. 2002;20(5):513–5.
- [29] Römer T, Bojahr B, Schwesinger G. Treatment of a torqued hematosalpinx in the thirteenth week of pregnancy using gasless laparoscopy. *J Am Assoc Gynecol Laparosc*. 2002;9(1):89–92.
- [30] Gorkemli H, Camus M, Clasen K. Adnexal torsion after gonadotrophin ovulation induction for IVF or ICSI and its conservative treatment. *Arch Gynecol Obstet*. 2002;267(1):4–6.
- [31] Buser KB. Laparoscopic surgery in the pregnant patient—one surgeon's experience in a small rural hospital. *JLS : J Soc Laparoendosc Surg*. 2002;6(2):121–4.
- [32] Haenggi D, Uehlinger U, Heinzl S. Adnexal torsion during pregnancy – management and literature overview. *Gynakol Rundsch*. 2003;43(1):39–42.
- [33] Huang PH, Tsai KB, Tsai EM, Su JH. Hemorrhagic corpus luteum cyst torsion in term pregnancy: a case report. *Kaohsiung J Med Sci*. 2003;19(2):75–8.
- [34] Phupong V, Manipalvirat S. Simultaneous tubal pregnancy and twisted ovarian cyst. *Arch Gynecol Obstet*. 2003;268(3):211–3.
- [35] Romano S, Bustan M, Shalev E. Fallopian tube detorsion in near-term pregnancy: a laparoscopic approach. *Gynaecol Endosc*. 2002;11(5):319–20.
- [36] Mathevet P, Nessah K, Dargent D, Mellier G. Laparoscopic management of adnexal masses in pregnancy: a case series. *Eur J Obstet Gynecol Reprod Biol*. 2003;108(2):217–22.
- [37] Born C, Wirth S, Stähler A, Reiser M. Diagnosis of adnexal torsion in the third trimester of pregnancy: a case report. *Abdom Imaging*. 2004;29(1):123–7.
- [38] Djavadian D, Braendle W, Jaenicke F. Laparoscopic oophorectomy for the treatment of recurrent torsion of the adnexa in pregnancy: case report and review. *Fertil Steril*. 2004;82(4):933–6.
- [39] Pan HS, Huang LW, Lee CY, Hwang JL, Chang JZ. Ovarian pregnancy torsion. *Arch Gynecol Obstet*. 2004;270(2):119–21.
- [40] Baksu A, Baksu B, Goker N. Laparoscopic unwinding and cyst aspiration of an ovarian torsion in spontaneous ovarian hyperstimulation syndrome associated with a singleton pregnancy. *Aust N Z J Obstet Gynaecol*. 2004;44(3):270–2.
- [41] Vijayaraghavan SB. Sonographic whirlpool sign in ovarian torsion. *J Ultrasound Med*. 2004;23(12) 1643–9; quiz 50–1.
- [42] Roman H, Accoeberry M, Bolandard F, Bourdel N, Lenglet Y, Canis M. Laparoscopic management of a ruptured benign dermoid cyst during advanced pregnancy. *J Minim Invasive Gynecol*. 2005;12(4):377–8.
- [43] Kumari I, Kaur S, Mohan H, Huria A. Adnexal masses in pregnancy: a 5-year review. *Aust N Z J Obstet Gynaecol*. 2006;46(1):52–4.
- [44] Wu JM, Chen KH, Lin HF, Tseng LM, Tseng SH, Huang SH. Laparoscopic appendectomy in pregnancy. *J Laparoendosc Adv Surg Tech A*. 2005;15(5):447–50.
- [45] Oto A, Ernst RD, Shah R, Koroglu M, Chaljub G, Gei AF, et al. Right-lower-quadrant pain and suspected appendicitis in pregnant women: evaluation with MR imaging—initial experience. *Radiology*. 2005;234(2):445–51.
- [46] Djakovic A, Hönig A, Gross M, Dietl J. Adnexal torsion in a patient with bichorial twin pregnancy in the 21st week of gestation treated by open laparoscopy: a case report. *Arch Gynecol Obstet*. 2006;274(4):248–9.
- [47] Birchard KR, Brown MA, Hyslop WB, Firat Z, Semelka RC. MRI of acute abdominal and pelvic pain in pregnant patients. *AJR Am J Roentgenol*. 2005;184(2):452–8.
- [48] Rackow BW, Patrizio P. Successful pregnancy complicated by early and late adnexal torsion after in vitro fertilization. *Fertil Steril*. 2007;87(3) 697.e9–12.
- [49] Cornfeld D, Scoutt L. Torsion of a hyperstimulated ovary during pregnancy: a potentially difficult diagnosis. *Emerg Radiol*. 2007;14(5):331–5.
- [50] Upadhyay A, Stanten S, Kazantsev G, Horoupian R, Stanten A. Laparoscopic management of a nonobstetric emergency in the third trimester of pregnancy. *Surg Endosc*. 2007;21(8):1344–8.
- [51] Palanivelu C, Rangarajan M, Senthilkumaran S, Parthasarathi R. Safety and efficacy of laparoscopic surgery in pregnancy: experience of a single institution. *J Laparoendosc Adv Surg Tech A*. 2007;17(2):186–90.
- [52] Zanforlin Filho SM, Araujo Júnior E, Serafini P, Guimarães Filho HA, Pires CR, Nardoza LM, et al. Diagnosis of ovarian torsion by three-dimensional power Doppler in first trimester of pregnancy. *J Obstet Gynaecol Res*. 2008;34(2):266–70.
- [53] Grgic O, Radakovic B, Barisic D. Hyperreactio luteinalis could be a risk factor for development of HELLP syndrome: case report. *Fertil Steril*. 2008;90(5) 2008.e13–6.
- [54] Renjit S, Morale EU, Mathew M. Isolated torsion of a tubal ectopic pregnancy—a rare event. *Oman Med J*. 2008;23(4):289–90.
- [55] Rauf A, Suraweera P, De Silva S. Operative laparoscopy: is it a safe option in pregnancy? *Gynecol Surg*. 2008;6(4):381.
- [56] Weitzman VN, DiLuigi AJ, Maier DB, Nulsen JC. Prevention of recurrent adnexal torsion. *Fertil Steril*. 2008;90(5) 2018.e1–3.
- [57] DiLuigi AJ, Maier DB, Benadiva CA. Ruptured ectopic pregnancy with contralateral adnexal torsion after spontaneous conception. *Fertil Steril*. 2008;90(5) 2007.e1–3.
- [58] Silja A, Gowri V. Torsion of a normal ovary in the third trimester of pregnancy: a case report. *J Med Case Rep*. 2008;2:378.
- [59] Singh Y, Shankar A, Dutta S, Chari V. Adnexal Torsion in second trimester of pregnancy. *Med J Armed Forces India*. 2008;64(2):193–4.
- [60] Wasik M, Phillips R, Griffiths AN, Sizer AR. Torted fimbrial cyst in pregnancy. *J Obstet Gynaecol*. 2008;28(1):104.
- [61] Prefumo F, Ciravolo G. Adnexal torsion in late pregnancy. *Arch Gynecol Obstet*. 2009;280(3):473–4.
- [62] Christopoulos P, Vitoratos N, Chassiakos D, Panoulis K, Papadias K. Adnexal torsion in the 10th week of a twin gestation. *J Obstet Gynaecol*. 2007;27(5):519–20.
- [63] Varghese U, Fajardo A, Gomathinayagam T. Isolated fallopian tube torsion with pregnancy—a case report. *Oman Med J*. 2009;24(2):128–30.
- [64] Arena S, Canonico S, Luzi G, Epicoco G, Brusco GF, Affronti G. Ovarian torsion in in vitro fertilization-induced twin pregnancy: combination of Doppler ultrasound and laparoscopy in diagnosis and treatment can quickly solve the case. *Fertil Steril*. 2009;92(4) 1496.e9–e13.
- [65] Pezzuto A, Steinkasserer M, Tricolore C, Ferrari B, Nardelli GB, Minelli L. Successful laparoscopic management of adnexal torsion during week 15 of a single pregnancy. *J Minim Invasive Gynecol*. 2010;17(6):686.
- [66] Kolluru V, Gurumurthy R, Vellanki V, Gururaj D. Torsion of ovarian cyst during pregnancy: a case report. *Cases J*. 2009;2:9405.
- [67] Eftekar Z, Rahimi-Moghaddam P, Yarandi F, Tahmasbi M. An ovarian torsion in severe spontaneous ovarian hyperstimulation syndrome associated with a singleton pregnancy. *J Obstet Gynaecol*. 2005;25(4):393–4.
- [68] Katz L, Levy A, Wiznitzer A, Sheiner E. Pregnancy outcome of patients with dermoid and other benign ovarian cysts. *Arch Gynecol Obstet*. 2010;281(5):811–5.
- [69] Giulini S, Dante G, Xella S, La Marca A, Marsella T, Volpe A. Adnexal torsion during pregnancy after oocyte in vitro maturation and intracytoplasmic sperm injection cycle. *Case Rep Med*. 2010;2010.
- [70] Boswell KM, Silverberg KM. Recurrence of ovarian torsion in a multiple pregnancy: conservative management via transabdominal ultrasound-guided ovarian cyst aspiration. *Fertil Steril*. 2010;94(5) 1910.e1–3.
- [71] Ramesh B, Geeta U, Kavitha C. Successful laparoscopic management of adnexal torsion during pregnancy: a case report. *J Obstet Gynaecol India*. 2010;60(4):337.
- [72] Kayabasoglu F, Aydogdu S, Yilmaz SE, Sarica E. Torsion of the previously normal uterine adnexa in the second trimester of pregnancy. *Arch Gynecol Obstet*. 2010;282(6):655–8.
- [73] Efthimiadis C, Kosmidis C, Grigoriou M, Anthimidis G, Vasiliadou K, Ioannidis A, et al. The role of laparoscopic surgery in pregnant women with nonobstetric acute abdomen. *J Gynecol Surg*. 2010;26(4):251–3.
- [74] Chang EM, Kim A, Kim JW, Yoon TK. Ultrasound-guided transvaginal aspiration as initial treatment for adnexal torsion following ovarian hyperstimulation. *Eur J Obstet Gynecol Reprod Biol*. 2010;152(1) 60–3.
- [75] Terzić M, Aksam S, Maričić S, Arsenović N. Acute abdomen caused by adnexal torsion in the first trimester of pregnancy: a case report. *Srp Arh Celok Lek*. 2011;139(3–4) 239–41.

- [76] ten Cate A, Han S, Vliegen AS, Lewi L, Verhaeghe J, Claus F. Conservative surgery for left-sided isolated tubal torsion in pregnancy. *JBR-BTR : organe de la Societe royale belge de radiologie (SRBR) = orgaan van de Koninklijke Belgische Vereniging voor Radiologie (KBVR)*. 2011;94(4):212–3.
- [77] Simsek Y, Ustun Y, Kaymak O, Akbaba E, Danisman N, Sirvan L. Hydronephrosis of pregnancy associated with torsion of the fallopian tube: a case report. *Eur Rev Med Pharmacol Sci*. 2011;15(4):448–51.
- [78] Choudhary D, Biswas R, Nigam A. Isolated fallopian tube torsion in early pregnancy presenting as resolving appendicular lump. *Eur Rev Med Pharmacol Sci*. 2011;15(4):446–7.
- [79] Shirokane M, Kikuchi F, Satomi M, Suzuki S. Isolated torsion of a left normal fallopian tube during pregnancy. *J Nippon Med Sch*. 2011;78(1):40–1.
- [80] Chohan L, Ramirez MM, Wray CJ, Kilpatrick CC. Laparoscopic management of fallopian tube torsion at 35 weeks of gestation: case report. *J Minim Invasive Gynecol*. 2011;18(3):390–2.
- [81] Al Omari W, Ghazal-Aswad S, Sidky IH, Al Bassam MK. Ovarian salvage in bilaterally complicated severe ovarian hyperstimulation syndrome. *Fertil Steril*. 2011;96(2):e77–9.
- [82] Kibbey K, Vincent A. Premature surgical menopause and factor V Leiden heterozygosity: case report and literature review. *Climacteric: J Int Menopause Soc*. 2011;14(1):185–8.
- [83] Uchil D, Guha C, Fleming A. Prostatic tissue in an ovarian dermoid. *J Minim Invasive Gynecol*. 2011;18(6):S119–S20.
- [84] Ergenoğlu M, Yeniel O, Peker N, Turan V, Karadadas N. Tubal torsion during pregnancy—case report. *Ginekol Pol*. 2011;82(4):287–90.
- [85] Koo YJ, Kim TJ, Lee JE, Kwon YS, Kim HJ, Lee IH, et al. Risk of torsion and malignancy by adnexal mass size in pregnant women. *Acta Obstet Gynecol Scand*. 2011;90(4):358–61.
- [86] Akl A, Abuzeid MI. A unique case of adnexal torsion. *J Gynecol Surg*. 2012;28(5):359–61.
- [87] Spitzer D, Wirleitner B, Steiner H, Zech NH. Adnexal torsion in pregnancy after assisted reproduction – case study and review of the literature. *Geburtshilfe Frauenheilkd*. 2012;72(8):716–20.
- [88] Passarinho RM, Afonso E, Reis L, Santos Silva I. Adnexal torsion in third trimester of pregnancy. *BMJ Case Rep*. 2012;:2012.
- [89] Poster Presentations, P2. *BJOG*. 2012;119(s1) 136–57.
- [90] Duncan R, Shah M. Laparoscopic salpingectomy for isolated fallopian tube torsion in the third trimester. Case reports. *Obstet Gynecol*. 2012;:2012.
- [91] Tsai S-w. Single-incision laparoscopic Detorsion and Oophorectomy during pregnancy. *J Minim Invasive Gynecol*. 2012;19(6):S179.
- [92] Gaspar-Oishi MA, Kawelo RM, Bartholomew ML, Aeby T. Transvaginal ovarian cystectomy for adnexal torsion during pregnancy. *J Minim Invasive Gynecol*. 2012;19(2):255–8.
- [93] Behar N, Calil M, Silva A, Pereira W, Bretz P, Mameri F. W211 ovarian tumor and pregnancy: twisted giant cyst. *Int J Gynecol Obstet*. 2012;119 S773–S4.
- [94] Tsafiriz Z, Hasson J, Levin I, Solomon E, Lessing JB, Azem F. Adnexal torsion: cystectomy and ovarian fixation are equally important in preventing recurrence. *Eur J Obstet Gynecol Reprod Biol*. 2012;162(2):203–5.
- [95] Lazaridis A, Maclaran K, Behar N, Narayanan P. A rare case of small bowel obstruction secondary to ovarian torsion in an IVF pregnancy. *BMJ Case Rep*. 2013;:2013.
- [96] Kaïdo Y, Kikuchi A, Kanasugi T, Fukushima A, Sugiyama T. Acute abdomen due to ovarian congestion: a fallopian tube accompanied by a paratubal cyst, coiling tightly round the ovary. *J Obstet Gynaecol Res*. 2013;39(1):402–5.
- [97] Tsai HC, Kuo TN, Chung MT, Lin MY, Kang CY, Tsai YC. Acute abdomen in early pregnancy due to ovarian torsion following successful in vitro fertilization treatment. *Taiwan J Obstet Gynecol*. 2015;54(4) 438–41.
- [98] Morton MJ, Masterson M, Hoffmann B. Case report: ovarian torsion in pregnancy – diagnosis and management. *J Emerg Med*. 2013;45(3) 348–51.
- [99] Dursun P, Gülümser C, Çağlar M, Araz C, Zeyneloğlu H, Haberal A. Laparoendoscopic single-site surgery for acute adnexal pathology during pregnancy: preliminary experience. *J Maternal-Fetal Neonatal Med*. 2013;26(13) 1282–6.
- [100] Munshi S, Patel A, Banker M, Patel P. Laparoscopic detorsion for bilateral ovarian torsion in a singleton pregnancy with spontaneous ovarian hyperstimulation syndrome. *J Hum Reprod Sci*. 2014;7(1) 66–8.
- [101] Frederick S, Frederick J, Harriot J, Christie L. Laparoscopic ovarian ligament plication in pregnancy. *West Indian Med J*. 2013;62(2) 158–60.
- [102] Maurice J, Freedman A, Hardesty J. Torsion of adnexal mass in a patient at 22 weeks gestation. *J Minim Invasive Gynecol*. 2013;20(6):S101.
- [103] Pérez-Rodríguez O, Ortiz-Oramas A, Stuart-Vazquez B. Laparoscopic management of an adnexal torsion with transabdominal oophorectomy performed in a first trimester pregnant woman: a case report. *Boletín de la Asociación Médica de Puerto Rico*. 2013;105(1) 40–1.
- [104] Sidiropoulou Z, Setúbal A. Acute abdomen in pregnancy due to isolated fallopian tube torsion: the laparoscopic treatment of a rare case. *World J Clin Cases: WJCC*. 2014;2(11):724.
- [105] Chandrasekar D, Chupi J, Agarwal N, Odejinmi F. Case study—isolated torsion of the fallopian tube as a reason for ectopic pregnancy; Pierre Dionis revisited? *BJOG Int J Obstet Gynaecol*. 2014;121:15–6. Wiley-Blackwell 111 River St, Hoboken 07030–5774, NJ USA.
- [106] Büke B, Şahin G, Demir S, Akdoğan A, Tavmergen E, Göker ET. Diagnosis of pregnancy after conservative management for adnexal torsion due to ovarian hyperstimulation in the same cycle. *JBRA Assist Reprod*. 2014;18(3):88.
- [107] El-Agwany AS. Gangrenous paraovarian cyst with pregnancy: an unusual presentation. *Res J Med Sci*. 2014;8:50–2.
- [108] Bakacak M, Bakacak Z. Isolated torsion of fallopian tube complicating pregnancy: case report. *Clin Exp Obstet Gynecol*. 2014;41(3):362–3.
- [109] Yildirim N, Ağı Yildirim, Akdemir A, Am Ergenoğlu, Aö Yeniel. Isolated torsion of the fallopian tube with ectopic pregnancy: case report. *Journal of Clin Obstet Gynecol*. 2014;24(2) 120–2.
- [110] Sun Y, Liu L-I, Di J-m. Isolated tubal torsion in the third trimester of pregnancy: a case report and review of the literature. *J Res Med Sci*. 2014;19(11):1106.
- [111] Aydin T, Yucel B. Laparoscopic management of adnexal torsion in a twin, in vitro fertilization pregnancy at 23 weeks. *Videosurg Other Minim Invasive Tech*. 2014;9(4) 655–7.
- [112] Tan KH, Chen KC, Wang TL, Chong CF, Chen CC. Ovarian cystic teratoma torsion in pregnancy. *Emerg Med J*. 2010;27(11):879–80.
- [113] Single incision laparoscopic surgery in pregnancy: A case report and review of the literature. In: Al-Badawi I, Alshankiti H, Ahmad S, editors. 18th World Congress On Controversies In Obstetrics Obstetrics, Gynecology & Infertility (Cogi); 2014.
- [114] Feng Z, Yin L, Zhang Y, Ma K. Successfully laparoscopic management of adnexal torsion in a mid-term twin pregnancy. *J Minim Invasive Gynecol*. 2014;21(6) S218–S9.
- [115] Priyadarisini K. Torsion of ovarian cyst in first trimester of pregnancy: a case report. *J Reprod Infertil*. 2014;5(3) 76–7.
- [116] AA MM, Opara E. Acute abdominal distension in early pregnancy from torqued ovarian serous cystadenoma. *J Obstet Gynaecol*. 2014;34(1):88.
- [117] Graziano A, Monte GL, Engl B, Marci R. Recurrent ovarian torsion in a pregnancy complicated by ovarian hyperstimulation syndrome. *J Minim Invasive Gynecol*. 2014;21(5):723–4.
- [118] Kaur K, Verger C, Awala A. Isolated fallopian-tube torsion: a case series. *J Gynecol Surg*. 2014;30(3) 184–6.
- [119] Surampudi K, Nirmalan PK, Gundabattula SR, Chandran JB. Management of adnexal masses in pregnancy: our experience from a tertiary referral perinatal Centre in South India. *Arch Gynecol Obstet*. 2015;291(1) 53–8.
- [120] Takeda A, Hayashi S, Imoto S, Sugiyama C, Nakamura H. Pregnancy outcomes after emergent laparoscopic surgery for acute adnexal disorders at less than 10 weeks of gestation. *J Obstet Gynaecol Res*. 2014;40(5) 1281–7.
- [121] Ekin M, Kaya C, Cengiz H, Yasar L, Dogan K. A rare case: ruptured ectopic pregnancy with contralateral adnexal torsion. *Bakırköy Tıp Dergisi*. 2015;11(1):29–32.
- [122] Kim Y, Han H, Sang J. Adnexal torsion in early pregnancy after assisted reproduction: can the adnexa be saved? *Clin Exp Obstet Gynecol*. 2017;44(1) 135–7.
- [123] Polat İ, Ekiz A, Atis A, Ozkose B, Ustun B, Gedikbasi A. Advanced tubal ectopic pregnancy with tubal torsion. *J Gynecol Surg*. 2015;31(5) 296–8.
- [124] Mathew M, Mubarak S, Jesrani S. Case report: conservative management of twisted ischemic adnexa in early pregnancy. *Ann Med Health Sci Res*. 2015;5(2) 142–4.
- [125] Lee DH, Park YK. Isolated fallopian tube torsion during pregnancy: a case report. *Clin Exp Obstet Gynecol*. 2015;42(5):681–2.
- [126] Rouzi AA, Mousa A, Sahly N, Alzahrani T. Laparoscopic treatment of ovarian Torsion in ovarian hyperstimulation syndrome in pregnancy. *J Minim Invasive Gynecol*. 2015;22(6):S216.
- [127] Li Q, Li X, Zhang P. Ovarian torsion caused by hyperreactio luteinalis in the third trimester of pregnancy: a case report. *Int J Clin Exp Med*. 2015;8(10) 19612–5.
- [128] Smolinski SE, Kreychman A, Catanzano T. Ovarian torsion: multimodality review of imaging characteristics. *J Comput Assist Tomogr*. 2015;39(6) 922–4.
- [129] Özler S, Öztaş E, Ersoy A, Kirbaş A, Şahin D, Danişman N. Pregnancy with bilateral dermoid cyst and unilateral ovarian torsion: a case report. *Cukurova Med J*. 2015;40(4) 814–7.
- [130] Williams J, Ikomi A, Karunaratne C, Angala P. Refractory disseminated intravascular coagulation following ovarian torsion and rupture in a pregnant patient. *Br J Med Pract*. 2015;8(1) 40–3.
- [131] Iyşwaria R, Saraswathi K. Ruptured tubal ectopic pregnancy with ipsilateral Torsion ovarian cyst. *Res J Pharm, Biol Chem Sci*. 2015;6(6) 687–90.
- [132] Kim M, Lee C, Ko J, Choi H, Cho Y, Chun K. Torsion of ovarian leiomyoma in a woman with 10 weeks' gestation. *J Minim Invasive Gynecol*. 2015;22(6) S201–S2.
- [133] Basaranoglu S, Agacayak E, Tunc S, Icen M, Turgut A, Peker N, et al. Clinical experience in pregnancies complicated by adnexal torsion. *Clin Exp Obstet Gynecol*. 2016;43(3):345–9.
- [134] Habek D, Bauman R, Kralj LR, Hafner T, Turudic T, Vujisic S. Acute abdomen in the 17th week of twin pregnancy due to ovarian torsion—a late complication of IVF. *Geburtshilfe Frauenheilkd*. 2016;76(12) 1345–9.
- [135] Petresin J, Wolf J, Emir S, Müller A, Boosz A. Endometriosis-associated maternal pregnancy complications—case report and literature review. *Geburtshilfe Frauenheilkd*. 2016;76(08):902–5.
- [136] Lai CWS, Shek NWM. Fetal meconium peritonitis and maternal liver disease. *Obstet Gynecol*. 2016;127(4) 740–3.
- [137] Kahramanoglu I, Eroglu V, Turan H, Kaval G, Sal V, Tokgozoglu N. Isolated adnexal torsion in a 20-week spontaneous twin pregnancy. *Int J Surg Case Rep*. 2016;:23 138–40.
- [138] Özlü T, Karatas A, Çetin Ç, Albayrak Ö. Isolated torsion of the fallopian tube with and without pregnancy: report of two cases. *J Turk Ger Gynecol Assoc*. 2016;17: S158.
- [139] Wyckoff ET, Bruggeman BJ, Patrick KE. Juvenile granulosa cell tumor as a cause of ovarian torsion complicating pregnancy. *J Gynecol Surg*. 2016;35(1):30–2.
- [140] Ding D-C, Chang Y-H. Laparoendoscopic single-site surgical cystectomy of a twisted ovarian dermoid cyst during early pregnancy: A case report and literature review. *Gynecol Min Invasive Ther*. 2016;5(4) 173–7.
- [141] Kim M. Laparoscopic management of a twisted ovarian leiomyoma in a woman with 10 weeks' gestation: case report and literature review. *Medicine*. 2016;95(44).
- [142] Warda H, Hota L. Laparoscopic management of ovarian torsion in a 1st trimester pregnant patient. *J Minim Invasive Gynecol*. 2016;23(7):S148.

- [143] Gobara A, Yoshizako T, Yoshida R, Okada N, Makihara K, Kitagaki H. Magnetic resonance imaging features of massive ovarian edema in pregnancy: utility for decisions in expectant management. *Springerplus*. 2016;5(1):1–4.
- [144] Koumoutsea EV, Gupta M, Hollingsworth A, Gorry A. Ovarian torsion in the third trimester of pregnancy leading to iatrogenic preterm delivery. *Case reports. Obstet Gynecol*. 2016;2016.
- [145] Ramirez E. Removal of a 15 cm ovarian torsion during second trimester pregnancy using a single-site robotic platform: case report and surgical technique. *J Minim Invasive Gynecol*. 2016;23(7):S247.
- [146] Ganesh D, Rajkumar A, Rajkumar J, Guru V. Ruptured ectopic pregnancy with contralateral ovarian serous cyst adenoma torsion: laparoscopic management of double trouble. *Case reports. Obstet Gynecol*. 2016;2016.
- [147] Güraslan H, Kanawati A, Güven E, Kaya C. Successful treatment of an isolated torsion of a fallopian tube in pregnancy with laparoscopic surgery: A case report. *J Turk Ger Gynecol Assoc*. 2016;17:5303.
- [148] Karatas A, Özlü T, Çetin Ç, Albayrak Ö, Topçuoğlu MA. Third trimester bilateral ovarian torsion in the presence of bilateral ovarian cysts: a case report. *J Turk Ger Gynecol Assoc*. 2016;17:5341.
- [149] Vaswani B, Laddad M. Torsion of ovarian cyst during pregnancy—a case report. *J Evol Med Dent Sci*. 2016;5(93):6897–9.
- [150] Minig L, Otaño L, Cruz P, Patrono MG, Botazzi C, Zapardiel I. Laparoscopic surgery for treating adnexal masses during the first trimester of pregnancy. *J Minim Access Surg*. 2016;12(1):22.
- [151] Bras R, Braga J, Tomé A, Ferreira H. Adnexal torsion in the first trimester of pregnancy: diagnosis, laparoscopic management, and review of the literature. *Surg Technol Int*. 2017;30 s.
- [152] Kaur N, Kaur N, Saini S. An intrauterine pregnancy with Tubo-ovarian Torsion mimicking ruptured tubal ectopic pregnancy. *J South Asian Fed Obstet Gynaecol*. 2017;9(1):56–9.
- [153] Prabhu T, Velayudam D. Conservative management of theca lutein cyst accident: a case report. *Int J Med Res Health Sci*. 2017;6(10):163–4.
- [154] Bouquet de Joliniere J, Dubuisson JB, Khomsi F, Fadhlouai A, Grant G, Ali NB, et al. Laparoscopic adnexectomy for ovarian torsion during late pregnancy: case report of a non-conservative treatment and literature analysis. *Front Surg*. 2017;4:50.
- [155] Gil Navarro N, Garcia Grau E, Pina Pérez S, Ribot Luna L. Ovarian torsion and spontaneous ovarian hyperstimulation syndrome in a twin pregnancy: a case report. *Int J Surg Case Rep*. 2017;34:66–8.
- [156] Kunovsky L, Kala Z, Mitas L, Can V, Dolina J, Nemcová E, et al. Rare cases imitating acute appendicitis: three case reports and a review of literature. *Rozhledy v chirurgii : mesicnik Ceskoslovenske chirurgicke spolecnosti*. 2017;96(2):82–7.
- [157] Nasiri A, Rahimi S, Tomlinson E. *iMedPub Journals*.
- [158] Guterman S, Mandelbrot L, Keita H, Bretagnol F, Calabrese D, Msika S. Laparoscopy in the second and third trimesters of pregnancy for abdominal surgical emergencies. *J Gynecol Obstet Hum Reprod*. 2017;46(5) 417–22.
- [159] Asch E, Wei J, Morteale KJ, Humm K, Thornton K, Levine D. Magnetic resonance imaging performance for diagnosis of ovarian torsion in pregnant women with stimulated ovaries. *Fertil Res Pract*. 2017;3(1):1–10.
- [160] Hosny TA. Oophorectomy for ovarian torsion: a new easier technique. *Gynecol Surg*. 2017;14(1):7.
- [161] Shore EM, Vlachou PA, Yudin MH. Laparoscopic treatment of tubal torsion in pregnancy. *J Gynecol Surg*. 2018;34(3) 174–6.
- [162] Jones A, Thomas C, Shamsuddin L. Laparoscopy in pregnancy: dermoid Torsion in the second trimester. *J Minim Invasive Gynecol*. 2018;25(7) S230-S1.
- [163] Al Salmi IS, Al-Douri F, Haider EA, Menezes TM. Magnetic resonance imaging findings in ovarian torsion post in vitro fertilization. *Radiol Case Rep*. 2018;13(6): 1154–8.
- [164] Soundararajan P, Chandrasekharan A, Rangasami R, Murali A, Ramachandran R. Adnexal masses in pregnancy: added value of magnetic resonance imaging in guiding patient management—our initial experience. *J South Asian Fed Obstet Gynaecol*. 2018;10(3):204–8.
- [165] Tankou J, Schantz-Dunn J, Liu CY, Melamed A. Dermoid cyst management and pathologic outcomes: a review of over 1,000 cases at a single institution [9D]. *Obstet Gynecol*. 2018;131:43S.
- [166] Tanaka Y, Tsuboyama T, Yamamoto K, Terai Y, Ohmichi M, Narumi Y. A case of torsion of a normal ovary in the third trimester of pregnancy: MRI findings with emphasis on asymmetry in the diameter of the ovarian veins. *Radiol Case Rep*. 2019; 14(3):324–7.
- [167] Levin G, Knigin D, Porat S, Abu-Daya M, Mankuta D, Gil M, et al. An unusual case of ovarian torsion in a pregnant woman with prior history of ipsilateral salpingectomy. *J Obstet Gynaecol*. 2019;39(6):870–1.
- [168] Khalife D, Nassif J, Nazha B, Khalifeh I, Khoury S, Khalil A. An unusual case of struma ovarii causing ovarian torsion during pregnancy. *J Obstet Gynaecol*. 2019;39(5): 716–7.
- [169] Park SN. Isolated tubal torsion in the third trimester of pregnancy managed with simultaneous salpingectomy and cesarean section. *Yeungnam Univ J Med*. 2019; 36(1):59–62.
- [170] Halimeh R, Tomassian S, El Hage M, Metri N, Bersaoui M, Daou R, et al. Laparoscopic adnexal Detorsion in a 20-week pregnant patient: a case report and literature review. *Case Rep Obstet Gynecol*. 2019;2019:1093626.
- [171] Uyanikoglu H, Sak E, Incebiyik A, Hilali N. Successful laparoscopic management of adnexal torsion in a third trimester pregnant woman: a case report. *J Clin Anal Med*. 2019;10(2):250–2.
- [172] Hua D, Zhao P, Jiang L. Torsion of ovarian endometrioma in pregnancy: a case report and review of the literature. *Trop Dr*. 2019;49(3):221–3.
- [173] Guennoun S, Guennoun A, Krimou Y, Gounain FZ, Mamouni N, Erraray S, et al. Adnexal torsion and pregnancy: about 3 cases. *Eur J Obstet Gynecol Reprod Biol*. 2019;234:e208.
- [174] Chavan NN, Deshmukh R, Raj N. An observational study on diagnosis and management of adnexal masses in pregnancy. *CEOG*. 2019;46(4):583–6.
- [175] Yu C, Wang J, Lu W, Xie X, Cheng X, Li X. Analysis of adnexal mass managed during cesarean section. *Adv Clin Exp Med*. 2019;28(4):447–52.
- [176] Butreanu T, Stoian I, Apetrei A-M, Dumitrascu R, Socolov D, Socolov R, et al. Adnexal masses in pregnancy: A two-center experience. *Med Surg J*. 2019;123(4): 689–95.
- [177] Sun Y, Feng G, Fu Y, You J, Li M, Zhu Y. Emergent complication of assisted reproductive technology: clinical analysis of 17 pregnant women with adnexal torsion. *Am J Emerg Med*. 2020;38(2):305–8.
- [178] Camelia TM, Sebastian P, Dragoş TŞ, Raluca CA, Cerasela M, Alexandra I, et al. Ovarian Tumors in Pregnancy; 2020..
- [179] Yıldırım H, Özđinc S. A rare condition in the third trimester of pregnancy: ovarian torsion. *Turk J Emerg Med*. 2020;20(1):42–5.
- [180] Bacalbaşa N, Bălescu I, Vilcu M, Dima S, Iliescu L, Brezean I. Cytoreductive surgery for advanced stage ovarian cancer in the second trimester of pregnancy—a case report and literature review. *Medicine*. 2020;99(29):e21127.
- [181] Takeda A, Kitami K, Shibata M. Magnetic resonance imaging and gasless laparoscopic single-site surgery for the diagnosis and management of isolated tubal torsion with a paratubal cyst at 31 weeks of gestation: A case report and literature review. *J Obstet Gynaecol Res*. 2020;46(8):1450–5.
- [182] Conte AB, Nyingone S, Jayi S, Diagne BJ, Alaoui FZF, Chaara H, et al. Management of adnexal masses' torsion during pregnancy. *Pan Afr Med J*. 2020;37:17.
- [183] Cagle-Colon KJ, Cagle T, Sze A. Ovarian torsion diagnosed in term pregnancy. *J Gynecol Surg*. 2020;36(4):220–1.
- [184] Hacıoğlu L, Karaman E, Dirik D, Karaaslan O, Kulusarı A, Şahin HG, et al. Ovarian torsion during pregnancy: a case of malignant ovarian cancer. *East J Med*. 2020;25(3): 465–7.
- [185] Wang YX, Deng S. Clinical characteristics, treatment and outcomes of adnexal torsion in pregnant women: a retrospective study. *BMC Pregnancy Childbirth*. 2020; 20(1):483.
- [186] Rasekhjehromi A, Goodarzi S, Kalani N. A case of ovarian torsion which led to abortion. *Acta Med Iran*. 2021;59(3):182.
- [187] Bernigaud O, Fraison E, Thiberville G, Lamblin G. Ovarian torsion in a twin pregnancy at 32 weeks and 6 days: a case-report. *J Gynecol Obstet Hum Reprod*. 2021;50(6):102117.
- [188] Osto M, Brooks A, Khan A. Ovarian cystic teratoma in pregnant women: conservative management or prophylactic oophorectomy? *Cureus*. 2021;13(8).
- [189] Thomas KC, Chon AH, Mestman J, Nguyen CT, Paulson RJ, Johnson B. A case report of severe hypothyroidism in pregnancy complicated by ovarian torsion: The role of medical treatment; 2021..
- [190] Ijarotimi O, Adeniyi O, Omitinde S, Ubom A, Momoh I, Adeyemi A. Right ovarian torsion and oophorectomy in second trimester of pregnancy with subsequent live birth at term. *J Clin Images Med Case Rep*. 2021;2(4):1239.
- [191] Harou K, Elbehja K, Nafidi M, Asmouki H, Soummami A. Adnexal torsion in pregnancy: should we conserve or not? *Open Access Libr J*. 2021;8(6):1–6.
- [192] Getaneh F, Underwood K, Seifi F. 65 ovarian torsion during 24th week of pregnancy: laparoscopic techniques for ovarian detorsion and oophorectomy. *Am J Obstet Gynecol*. 2021;224(6):S832.
- [193] Elbaum CC, Stork A, Miles S. Ovarian torsion of large adnexal mass in pregnancy: minimally invasive approach. *J Minim Invasive Gynecol*. 2021;28(9):1555–6.
- [194] Yu M, Liu Y, Jia D, Tian T, Xi Q. Adnexal torsion in pregnancy after in vitro fertilization: case report and literature review. *Medicine*. 2021;100(3):e24009.
- [195] Lee YJ, Kim SW, Kim Y. Ovarian mass combined with pancreatic neoplasm in pregnancy: a rare case report and literature review. *J Obstet Gynaecol Res*. 2022;48(1): 244–50.
- [196] Abbassi-Ghanavati M, Greer LG, Cunningham FG. Pregnancy and laboratory studies: a reference table for clinicians. *Obstet Gynecol*. 2009;114(6):1326–31.