Case Series

Role and spectrum of imaging in ovarian torsion

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Abstract

Ovarian torsion, an emergency abdominal and gynecological condition requiring immediate surgical intervention, is characterized by the twisting of ovary and its ligamentous attachment over its pedicle. As no specific clinical signs are there for accurate diagnosis, a radiologist may be the first person to make the diagnosis. Varying radiological findings on different modalities, namely ultrasonography (USG), computed tomography (CT), and magnetic resonance imaging are there characterizing ovarian torsion. Knowledge and understanding of these features can help radiologists make accurate diagnosis helping clinician for timely intervention. We here present a series of five different cases of ovarian torsion, demonstrating different and multiple imaging features of ovarian torsion on USG and CT.

Keywords: Computed tomography, ovarian masses, ovarian torsion, twisted ovarian pedicle, ultrasonography

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INTRODUCTION

One of the foremost gynecological emergencies requiring surgeries is ovarian torsion, with approximately 2.7%–3% prevalence rate.[1,2] Ovarian torsion is an emergency condition characterized by either partial or complete twisting of ovary (mostly along with the fallopian tube) on its ligamentous support, and vascular pedicle, causing vascular compromise of ovary and resulting in ovarian ischemia, infarction, and tissue necrosis.[3,4]

Prompt diagnosis can help in early intervention and ovarian salvage.[3] Imaging findings on different imaging modalities are available in literature. Due to the wider availability and ease of performance of ultrasonography (USG), it is often used as the first line of investigation[3-5] However, many times due to nonspecific clinical presentation and clinical diagnostic dilemma, computed tomography (CT) is often chosen over USG as initial investigation.[4,6,7] Even if the diagnostic dilemma persists on either USG or CT scan, Magnetic resonance imaging (MRI) is the next choice.[7] Whatever is the modality of investigation, radiologist may be the first clinical person to make the diagnosis, hence it becomes important for a radiologist to know different imaging findings to make a reliable diagnosis, helping clinicians expedite timely intervention. Here, we present five cases demonstrating different and multiple imaging features of ovarian torsion on USG and CT.

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CASE SERIES

Case 1

A 38-year-old female presented with acute pain in abdomen and two episodes of vomiting of 1-day duration and a lump-like feeling in the right lower abdomen for 3 months, for which she had not consulted any physician. No history of menstrual irregularity. On clinical examination, her vitals were stable. Per abdomen examination revealed a midline lump and tenderness in the lower abdomen. Transabdominal USG revealed a cystic mass lesion in midline, anterosuperior to uterus. Cyst showed some internal echogenic contents [Figure 1a]. Subsequently, transvaginal sonography (TVS) was done [Figure 1b and c] which showed cystic mass lesion measuring approximately 7.0 cm × 7.0 cm with internal echogenic contents, and no internal vascularity, placed in midline superior to uterine fundus. The right ovary was not seen separately. The left ovary was normal in size and location. Free fluid was seen in the pelvic cavity. The diagnosis of right ovarian twisted dermoid cyst was made on the basis of enlarged abnormally placed ovary and free fluid in the pelvis. The twisted pedicle sign was not demonstrable on USG. Surgery revealed right ovary with mass lesion twisted twice over the pedicle. Histopathology confirmed cyst to be dermoid cyst.

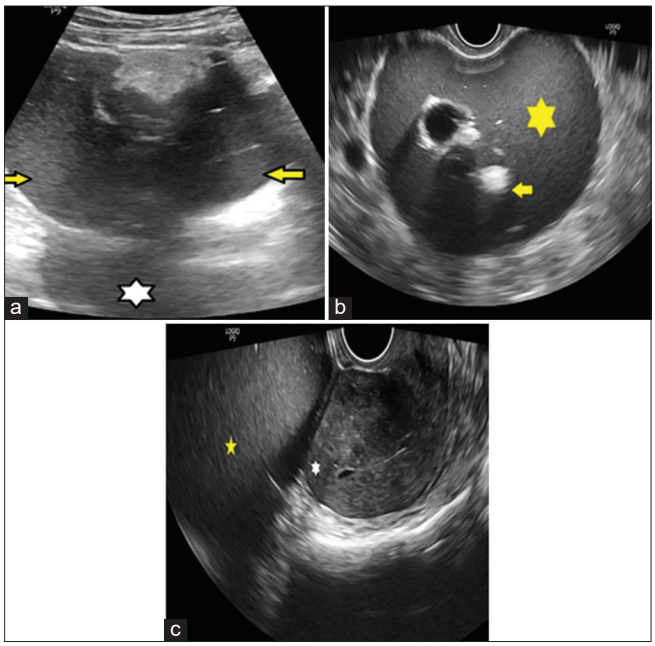

Figure 1: Ultrasonography (USG) images of the pelvis. (a) Gray scale transabdominal USG image of large midline placed ovarian dermoid cyst (yellow arrows), seen between anterior abdominal wall and displaced uterine fundus below (white asterisk), (b) Transvaginal USG image showing clearly the dermoid cyst (yellow asterisk) with internal echogenic fatty components (yellow arrow), (c) Transvaginal image clearly shows part of the dermoid cyst (yellow asterisk) superiorly placed to displaced uterine fundus (white asterisk)

Case 2

A 34-year-old, woman came with dull-aching pain in lower abdomen of 4 days' duration with nausea. Her vitals were stable. Per abdominal examination revealed mild tenderness in the left iliac region. She was sent for USG for evaluation. Transabdominal and transvaginal USG [Figure 2a and b] showed left enlarged ovary of approximately 6.2 cm × 5.0 cm with central echogenic stroma and peripherally displaced follicles. Color Doppler [Figure 2c] study reveals the absence of any internal flow in the ovary. Free fluid was seen in the pelvic cavity. A diagnosis of left ovarian torsion was made and the patient was taken for emergency laparoscopic surgery, an enlarged left ovary with infarction was seen, and left oophorectomy was done.

Case 3

A 26-year-old nulliparous woman presented with acute pain in lower abdomen with an episode of vomiting. The patient was under treatment for infertility for 1 year. A history of previous 2 failed cycles of ovulation induction was present. During her ovulation study on day 10 in the present cycle, two dominant follicles were seen in the right ovary. On the 15th day of her cycle, she presented with acute pain. Transabdominal USG [Figure 3a and b] reveals enlarged right ovary of approximately 11 cm × 6.0 cm, placed in lower abdomen in midline. Two cysts were seen within. One of the cysts showed internal septations suggesting internal hemorrhage. Color Doppler showed decreased internal vascularity. The left ovary was normal in size and normally placed in the left adnexa. On suspected ultrasound diagnosis of ovarian torsion, an immediate nonenhancing CT (NECT) abdominal scan was done for any further clue. NECT abdomen [Figure 3c and d] revealed enlarged, midline located right ovary of approximately 11 cm × 6.0 cm with two internal cysts. The thickened right pedicle was appreciable between uterus and enlarged right ovary. Engorged hyperdense twisted vessels resembling "whirlpool sign" were also appreciable within the thickened pedicle, even on NECT

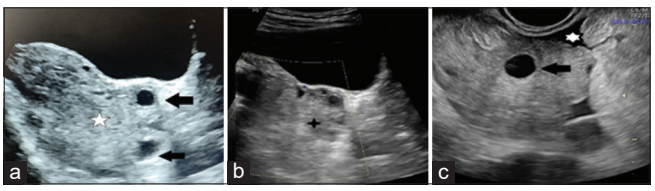

Figure 2: Ultrasonography (USG) images. (a) Transabdominal USG shows an enlarged left ovary with central echogenic stroma (white asterisk) with peripherally placed follicles (solid arrows), (b) Transabdominal color Doppler USG shows the absence of any color flow in the ovary (black diamond), (c) Transvaginal USG shows enlarged ovary with an echogenic rim around follicle – "follicular ring sign" (solid arrow). Free fluid is also seen (white asterisk)

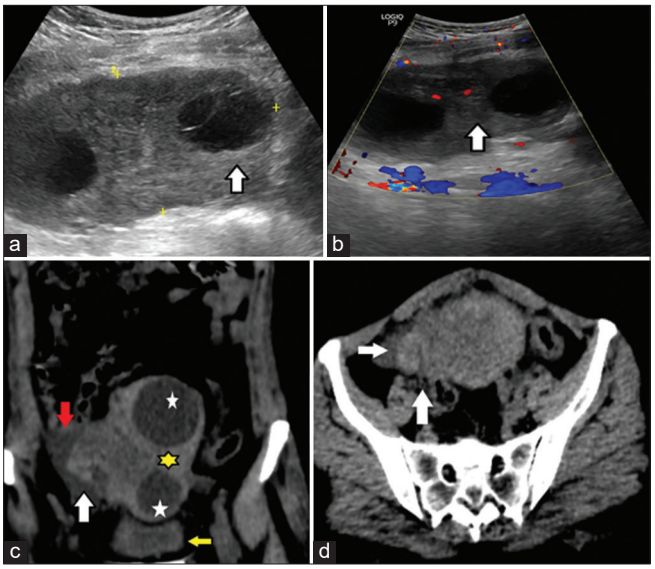

Figure 3: (a and b) Transabdominal ultrasonography (USG) images. (a) Gray scale USG showing enlarged right ovary in midline just below the anterior abdominal wall with two internal cysts. Internal septations suggesting internal hemorrhage were seen in a cyst (arrow), (b) Color Doppler USG showing decreased internal vascularity, (c) Noncontrast computed tomography (NECT) image. NECT coronal (c) and axial (d) images of abdomen-pelvis reveals – enlarged right ovary of 11 cm × 6.0 cm size (yellow asterisk) placed in midline superior to partially distended urinary bladder (yellow arrow). The ovary shows two variable-sized cysts (white asterisks). Note the engorged hyperdense vessels in twisted pedicle – giving whirlpool sign appreciation even on noncontrast images (white arrows). Free fluid also seen (red arrow)

scan. As ovarian vascularity was found on USG, immediate laparoscopy was done. Intraoperatively, an enlarged right ovary twisted twice over the pedicle was found. The ovary was dark blue colored. Detorsion was done and the ovary regained its color, was placed in a pouch of Douglas and could be salvaged.

Case 4

A 19-year-old young girl came with acute pain in abdomen and 3 episodes of vomiting. On clinical examinations, her vitals were stable. Per abdominal examination revealed guarding and tenderness in the right iliac region. On clinical suspicion of acute appendicitis, the patient was directly subjected to contrast-enhanced CT (CECT) of abdomen-pelvis. CT scan revealed a normal appendix but an enlarged right ovary in the right adnexa with multiple peripherally displaced follicles and normal enhancing central stroma (Figure 4a and b). Twisting of the right pedicle and ovarian vessels was seen showing "whirlpool sign." [Figure 4c and d]. Free fluid was seen in pelvic cavity On laparoscopy, enlarged edematous right ovary was seen. The right tube was edematous and twisted twice. As ovarian tissue appeared viable, detorsion of the ovary was done. Follow-up after 4 days by USG scan showed normal-sized right ovary with normal vascularity.

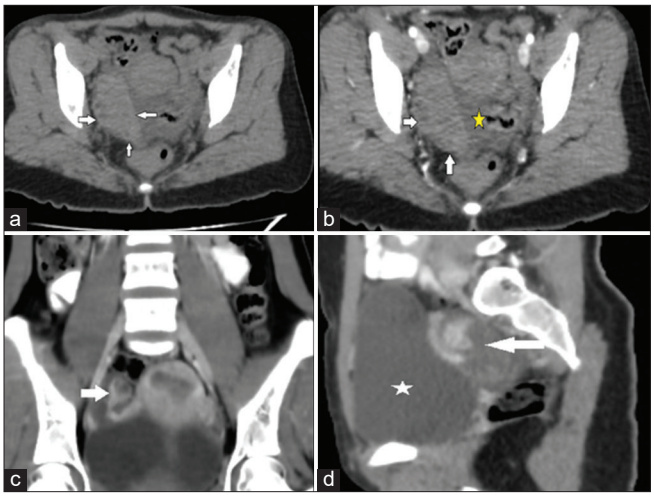

Figure 4: Computed tomography images of pelvis. (a) Noncontrast axial computed tomography (CT) image of the pelvis reveals enlarged, (6 cm × 3.5 cm) right ovary in the right adnexa with multiple small peripherally placed follicles (white arrows), (b) contrast-enhanced CT (CECT) axial image shows enhancing enlarged right ovary with multiple peripheral follicles (white arrows). Free fluid seen (yellow asterisk), (c and d) CECT coronal image, and sagittal images showing twisted right ovarian pedicle - "whirlpool sign" (white arrows). Distended urinary bladder (white star)

Case 5

A 42-year-old female with a history of irregular menstrual cycle and abdominal distention since 2 months presented with acute onset pain in the abdomen of 1 day duration. On per abdominal examination, a large soft lump was palpable in mid and lower abdomen. Transabdominal USG showed large cystic mass lesion in mid and lower abdomen. CECT abdomen pelvis was done for complete evaluation. CECT showed large approximately 18 cm × 14 cm cystic density thin walled mass lesion in midline, extending to the right adnexa [Figures 5a-c]. A thickened left pedicle with swirled ovarian vessels was seen [Figure 5b]. Surgery showed twisted enlarged left ovary with cystic mass lesion of approximately 20 cm, and oophorectomy was performed. Histopathology confirmed it to be serous cystadenoma of left ovary.

DISCUSSION

Ovarian enlargement

Although not specific to torsion, the most common finding in ovarian torsion is ovarian enlargement where ovary measures 4 cm or more in its maximum dimension.[4,7,8] A volume of more than 20 cm^3 in premenopausal women[8,9] more than 10 cm^3 in postmenopausal women is taken as ovarian enlargement.[7,9] The torsed enlarged ovaries, secondary to central edema and venous congestion, cause uniform peripheral displacement of follicles, which on imaging is seen as afollicular central stroma and multiple peripheral follicles. It is well demonstrated on USG and is more specific sign for torsion.[4,7-9]

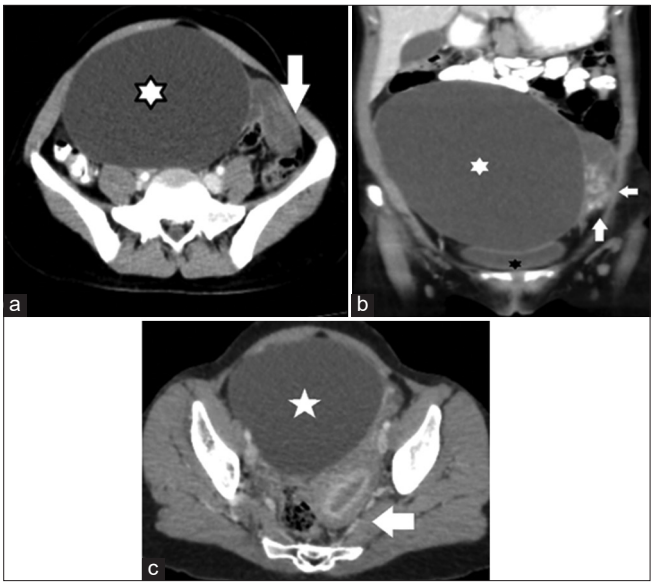

Figure 5: Contrast-enhanced computed tomography (CECT) images of the pelvis. (a) Axial CECT image of pelvis shows a large cystic mass lesion in midline, extending to right adnexa (white asterisk). No wall thickening or postcontrast enhancement noted. A hypodense thickened pedicle with engorged vessels on the left side (white arrow) suggesting torsion of left ovary with lead large mass lesion. (b) Coronal CECT image shows ovarian mass over compressed urinary bladder (black star) and thickened pedicle with multiple coiled enhancing vessels - giving a "helical swirl sign." (c) Axial CECT image shows midline left ovarian cyst (white star) and ipsilateral deviation of uterus (white arrow)

In our case series, ovarian enlargement, with or without mass lesion was seen in all cases. Singh *et al*.[8] and Khalil and El-Dieb[9] in their respective studies also found ovarian enlargement to be the most common finding in ovarian torsion. Another USG finding, more clearly demonstrable on transvaginal USG, is a hyperechoic rim, approximately 1–2 mm in thickness, surrounding antral follicles, which is known as "follicular ring sign."[4] Peripherally displaced follicles can sometimes be seen on CT scan as well[7] and if seen increases the specificity.[6] Doppler ultrasound can show reduced or absent flow in torsed ovaries, which is a sensitive sign of torsion, however presence of flow in vessels does not rule out torsion.[4,10] This can be due to the dual blood supply of ovary and preservation of arterial blood flow till late in the disease.[4,9] The value of Doppler study in ovarian torsion has been controversial.[4,9,10] Different studies demonstrated different results varying from decreased/absent venous flow[9,10] to noncontinuous flow pattern on pulsed Doppler.[4] Persistent arterial flow has been seen in surgically proven nonviable ovaries,[4] while absent or reversed diastolic flow has also been documented, thus making Doppler study unreliable in confirming torsion.[9] Torsion can occur in normal ovaries, right side reportedly commoner than left,[7,11] however an associated ovarian mass lesion, can be a leading and risk factor, which is higher in benign lesions.[7-9,12] In our series, three cases showed the presence of leading ovarian mass lesion. Multiple studies have documented ovarian mass lesions to be a risk factor for torsion. Physiological follicular cyst or corpus luteal cyst are found to be the most commonly associated ovarian lesions in torsion, and dermoid cyst being found as the most common benign tumor.[7,8] Torsion is less common in endometriomas and ovarian malignancies, due to higher chances of adhesion to adjacent structures.[13] The underlying ovarian masses can be well identified by imaging, each with its characteristic findings.[7,8] When benign cyst or follicular cyst are the lead cause of torsion, they may show wall thickening.[4,6,7] Simple edematous thickening is seen as smooth concentric thickening of the cyst wall while thickening following hemorrhagic infarction causes eccentric or irregular thickening of the cyst wall.[4]

Ovarian hyperstimulation syndrome (OHSS) following drug induction is risk factors for torsion.[8,9,14] Approximately 6%–16% ovarian torsion is reported in pregnant women with OHSS. Early diagnosis with USG (as CT scan is avoided in such patients) can help early intervention. Demonstration of whirlpool sign on USG has high diagnostic accuracy and specificity for torsion.[14] Furthermore, clinical and medical treatment history, bilaterality help in differentiation in these women.[8,9,14] Hyperstimulated torsed ovary shows asymmetrical enlargement (comparison with morphological appearance of other ovary can help), torsed ovary is more superficial placed on transabdominal USG with central edema and pelvic fluid.[8,9,15]

Twisted ovarian pedicle/thickened pedicle

The ligamentous pedicle connecting ovary to uterus, contains the fallopian tube and the vascular channels to ovaries.[9] Rotation of the pedicle causes twisting of the ovarian pedicle.[4,8,9,16] Demonstration of twisted pedicle on imaging is a characteristic and reliable sign of torsion.[8,9,17] Twisted pedicle sign was demonstrated in three of our cases. Duigenan *et al*.,[7] also documented, though not always seen but demonstration of twisted pedicle sign or swirling sign to be a pathognomonic and specific feature of torsion. Dynamic assessment on USG can help identify the twisted pedicle sign.[4,8] Twisted pedicle may be difficult to see on CT images,[4,6,7,9] however studying the images in multiple planes on CT can help identify the twisted pedicle sign.[4,8,18] Another finding usually present, however may be overlooked on CT, is thickened ipsilateral pedicle which can be seen as soft-tissue attenuating triangular structure at the anterolateral margin of the uterus.[4,6,19,20]

Ipsilateral deviated uterus

Abnormally placed enlarged ovary with ipsilaterally deviated uterus, appreciable on CT scan images has been proved to be an important sign of torsion.[12,19,21,22]

Ovarian enhancement pattern

Compromised blood supply results in abnormal enhancement of the torsed ovary on CECT scans. Minimal heterogeneous or absent enhancement suggests changes secondary to ischemia. Sometimes intermittent or recently torsed ovary can show normal postcontrast enhancement, hence normal enhancement does not rule out torsion.[6-8] Nonenhancing simple ovarian cyst and enlarged solid nonenhancing torsed ovary, on a CECT scan can sometimes be difficult to differentiate from each other, however looking for additional complex features such as internal heterogeneity and/or thickened or perceptible cyst wall in a torsed ovary helps it differentiate from simple nonenhancing ovarian cyst.[6,7] Although nonspecific free fluid in the abdomen-pelvic cavity is also seen in cases of ovarian torsion.[4,6-9,19,21]

Spontaneous ovarian detorsion

Spontaneous detorsion, though being documented in gynecological literature, is not much backed by sufficient imaging proof.[23] Ghossain *et al*.[23] in their study on few selected patients of ovarian torsion tried to document imaging findings of detorsion on USG and MRI modalities. Clinicoradiologically diagnosed patients of ovarian torsion, having spontaneous resolution of pain, without any treatment, were followed up by USG and/or MRI. They showed a return of ovarian size and stromal signals or thickened tube to their normal sizes in follow-up USG or MRI, suggesting high probability of spontaneous detorsion. They suggest logical approach to such diagnosis but emphasize on more research work for this entity.

CONCLUSIONS

The most common finding of torsion is an enlarged and edematous ovary with abnormal follicular arrangement with or without vascular compromise. The presence of a mass lesion increases the risk of torsion. These findings in association of abnormally placed ovary and demonstration of twisted pedicle sign are highly accurate features of ovarian torsion on both USG and CT scans. Due to overlapping and inconclusive clinical diagnosis of ovarian torsion, the familiarity of a radiologist with features of torsion on different imaging modalities can help clinician take immediate and proper measures of treatment, specifically in salvaging torsed ovary.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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