

# Ultrasonography and Magnetic Resonance Imaging in Ovarian Torsion - A Retrospective Study in Hoskote

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## ABSTRACT

### BACKGROUND

Ovarian torsion occurs when the ovary twists on its fibrovascular pedicle resulting in vascular compromise. Initially, there is twisting of the ovary, fallopian tube, or both structures, causing venous, lymphatic and arterial compromise with resultant ovarian oedema and adnexal enlargement. We wanted to determine the most common ultrasonography (USG) and magnetic resonance imaging (MRI) findings in surgically proven cases of ovarian torsion.

### METHODS

We present a series of cases obtained on retrospective review of USG and MRI findings in 10 surgically proven cases of ovarian torsion between June 2018 to June 2020 in the Department of Radiology, MVJ Medical College & Research Hospital, Hoskote.

### RESULTS

Significant enlargement of the ovary with size ranging from 5 to 15 cms with peripherally displaced follicles and free fluid in the pelvis is noted in all the patients on USG and MRI. Other common MRI features include 'twisted vascular pedicle' sign seen in 7 (70 %) cases, areas of haemorrhage within the ovarian stroma in 7 (70 %) cases and abnormal ovarian enhancement in 9 (90 %) cases.

### CONCLUSIONS

Ultrasound and MRI are the main diagnostic imaging modalities prior to treatment. Improved detection and characterisation of pelvic mass contributes to better diagnostic accuracy. The most common findings in US and MRI features of ovarian torsion include ovarian enlargement with peripherally displaced follicles and free fluid in pelvis. Other common MRI features include ovarian haemorrhage, twisted vascular pedicle, abnormal ovarian enhancement and deviation of the uterus towards the same side.

### KEYWORDS

Ovarian torsion, USG, MRI

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## BACKGROUND

Ovarian torsion occurs when the ovary twists on its fibrovascular pedicle resulting in vascular compromise. Initially, there is twisting of the ovary, fallopian tube, or both structures, causing venous, lymphatic and arterial compromise with resultant ovarian oedema and adnexal enlargement.<sup>1</sup>

The ovary is connected to the pelvic wall by infundibulopelvic ligament (suspensory ligament of the ovary), which holds it lateral or superior to the uterus. The ovarian blood vessels run along the suspensory ligament. The medial aspect of the ovary is connected to the uterus by the ovarian ligament, which is composed of muscle and fibrous tissue, vascularisation being provided by the uterine artery.

Twisting of the ovary on its suspensory ligament which contains the ovarian vessels, nerves and lymphatics result in a sequential vascular compromise. The low pressure venous and lymphatic structures are first affected with resultant ovarian oedema and enlargement. Persistent torsion causes stretching of the ovarian capsule and an increase in the ovarian pressure leading to arterial occlusion, thrombosis and haemorrhagic infarction of the ovary. Untreated torsion may lead to systemic infection, inflammation and even death.<sup>2</sup>

Adnexal torsion is an important cause of acute abdominal pain with a prevalence of 3 % of gynaecologic emergencies. Clinically majority of the patients present with acute onset of pelvic pain, nausea or vomiting, elevated temperature and white cell count. Torsion usually occurs in childhood and during the reproductive years and is uncommon after menopause. The incidence is most common in age group between 15 – 30 years. Torsion is commonly seen on the right side because the left lower quadrant of the abdomen is occupied by sigmoid colon, leaving little space for the ovary to tort.<sup>3,4</sup>

Torsion of a normal ovary usually occurs in children and younger women with especially mobile adnexa, allowing torsion at the mesosalpinx. Ovarian and parovarian cysts are recognised to be most common causes of ovarian torsion. Most neoplastic lesions causing torsion are benign. The most common neoplastic cause of adnexal torsion is benign cystic teratoma.<sup>4</sup>

Ovarian torsion often mimics other causes of acute abdomen such as appendicitis, diverticulitis, renal colic or gastroenteritis. Misleading clinical symptoms may result in a missed diagnosis and delay in treatment. Radiological imaging is therefore essential to facilitate an early diagnosis and a timely surgical intervention.

Ultrasound (US) is often the first modality of choice in evaluation of a female patient with lower abdominal pain. Patients who have atypical clinical or US findings, the diagnosis of ovarian torsion is challenging. Magnetic resonance imaging (MRI) can further help in characterisation of the lesion with its multiplanar imaging and good contrast resolution. Early detection of adnexal torsion is important because ovarian salvage is possible in early stages by surgical untwisting to prevent complications such as infarction and haemorrhagic necrosis.<sup>4,5</sup>

## Aim of the Study

We wanted to determine common USG and MRI findings in surgically proven cases of ovarian torsion.

## METHODS

This is a retrospective case series conducted from June 2018 to June 2020 at MVJ Medical College & Research Hospital, Hoskote, Bangalore Rural.

## Inclusion Criteria

Surgically proven cases of ovarian torsion who underwent pre-operative USG and MRI evaluation of pelvis based on clinical suspicion of ovarian torsion.

## Exclusion Criteria

Pregnant women, women who had undergone ovulation induction and who had inconclusive clinical, USG and MRI findings were excluded from the study.

## Equipment Used

1. GE Voluson E8 machine with 5-MHz curvilinear transducer for transabdominal examination and 7.5 MHz transvaginal sonography probe for the endovaginal ultrasound examination (transvaginal sonography was performed only in married women).
2. MR imaging was performed using a 1.5 - Tesla MRI (Magnetom Aera, Siemens). T1 - weighted images, T2 - weighted images, T2 - weighted fat saturated (FS) images, T1 - weighted FS images; and T1 - weighted FS images after intravenous injection of 0.1 mmol / kg of gadopentetate dimeglumine (Magnevist) were acquired.

Sonographic features include ovarian enlargement (by its size and volume), peripheral displacement of follicles, oedematous echogenic ovarian stroma, and fluid in cul-de-sac. Using colour Doppler sonography, flow was assessed for vasculature whether it is normal, decreased, or absent flow when compared to contralateral ovary and twisted vascular pedicle in the form of loops, coils or the classically described whirlpool sign.<sup>6</sup>

In the retrospective evaluation the most common MRI findings were ovarian enlargement with or without associated lesion, peripherally displaced follicles in the ovary, stromal oedema in the form of T2 hyperintensity, ovarian haemorrhage in the form of heterogeneous T1 and T2 signal intensities, twisted vascular pedicle, fallopian tube wall thickening, deviation of the uterus on the same side, fluid in the pelvis, abnormal ovarian enhancement.<sup>4,6,7</sup>

## RESULTS

In this study, 10 cases of surgically proven ovarian torsion were included. The mean patient age was 27 years (range,

10 – 50 years). Seven patients (70 %) were of childbearing age (20 – 39 years), two were children - < 18 years (20 %), and one was postmenopausal (10 %). Most of the patients presented with severe non-specific lower abdominal pain and pelvic pain, nausea and vomiting.

On USG, there is significant enlargement of the ovary with size ranging from 5 to 15 cm in all patients (100 %). Ovarian enlargement was reported on the right side in 8 cases (80 %) and on left side in 2 cases (20 %). Peripherally displaced follicles and cul-de-sac collection were found in all 10 patients. Oedematous echogenic ovarian stroma was noted in 8 cases. Ovarian cysts were found in 7 cases and dermoid in 1 case. Ovarian enlargement with peripherally displaced follicles and free fluid in pelvis were found to be the most common findings on ultrasound.

Colour Doppler imaging shows abnormal central vasculature in 7 cases; in 3 of them flow was absent and in the other 2 it was decreased. The classic whirlpool sign in the form of abnormally tortuous vessels was depicted in 2 cases only. Normal flow was seen in 3 cases. The presence of arterial or venous flow or both does not exclude the diagnosis of torsion. Venous thrombosis leads to symptoms before arterial occlusion and that persistent adnexal arterial flow is related to the dual-ovarian arterial supply (ovarian artery and ovarian branches of uterine artery).

On MRI, all patients showed enlarged ovary with peripheral displacement of follicles. Stromal oedema showing increased T2 signal intensity was seen in eight cases. Subacute haemorrhage showing hyperintense signal intensity on T1W, T2W sequences and not suppressed on FS sequences within the ovarian stroma was seen among 3 cases. Patients who had ovarian haemorrhage were found to have infarcted ovaries intraoperatively. Underlying pathological lesions were simple cystic lesions in 5 cases without any solid components, haemorrhagic cysts in two cases and dermoid in one case.

In six patients, non-enhancement of ovarian stroma was seen. Intraoperatively all these patients had non-viable ovaries. Peripheral enhancing wall of ovaries were seen in two cases. In the early stage of ovarian torsion or intermittent torsion, normal enhancement may be seen. Nevertheless heterogeneous, minimal to absent enhancement is seen in infarcted ovaries. They may show only peripheral enhancement.

Uterine deviation towards the same side so that the ovary was seen in the midline was detected in 7 cases. The classic whirlpool sign was depicted in 6 cases. Two patients had breaking of the ovary into twisted pedicle.

All 10 patients diagnosed radiologically with ovarian torsion had undergone laparoscopic surgery. One patient underwent detorsion of the ovary. In nine patients, ovaries were found to be non-viable intra-operatively so unilateral salpingo-oophorectomy was performed.

USG Findings	No. of Cases
Ovarian enlargement	10
Peripherally displaced follicles	10
Oedematous echogenic stroma	8
Free fluid in POD	10
Underlying ovarian lesion	8

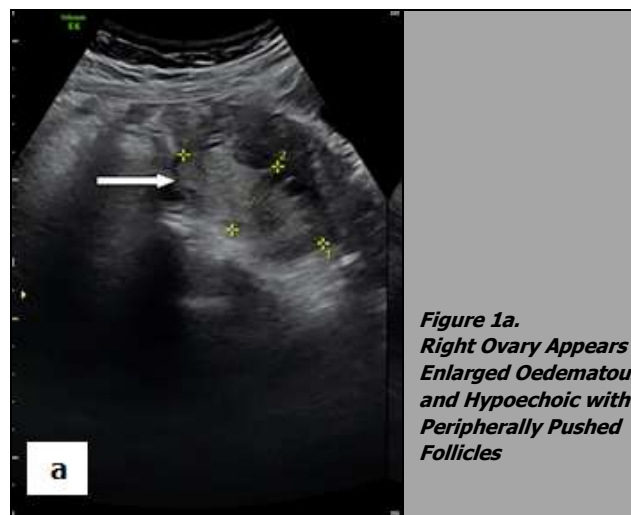
**Table 1. USG Findings in Ovarian Torsion**

Colour Doppler	Findings
Normal	3
Decreased	2
Absent	3
Twisted vascular pedicle	2

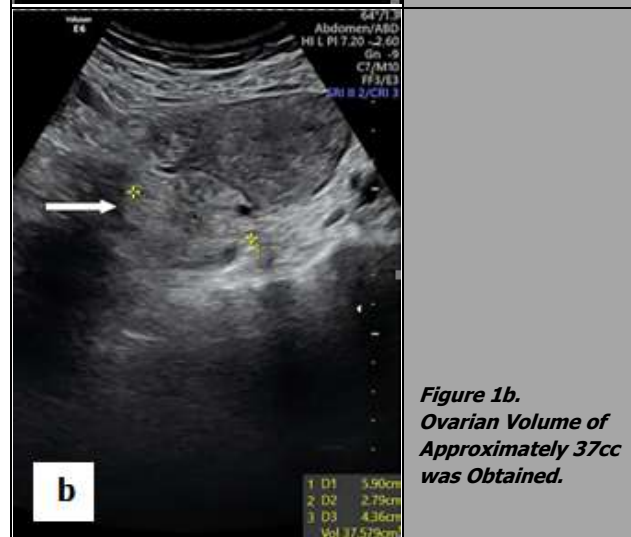
**Table 2. Colour Doppler Findings in Ovarian Torsion**

MRI Findings	No. of Cases
Ovarian enlargement	10
Peripherally located follicles	10
Subacute haemorrhage	3
Stromal oedema	8
Underlying ovarian lesion	8
Abnormal ovarian enhancement	9
Twisted vascular pedicle / whirlpool sign	6
Ipsilateral deviation of the uterus	7
Free fluid in POD	10

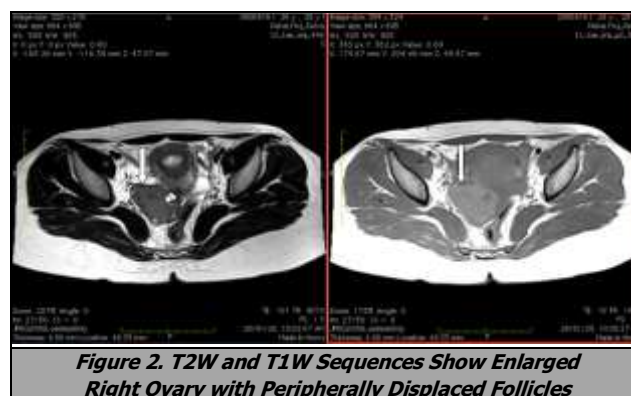
**Table 3. MRI Findings in Ovarian Torsion**



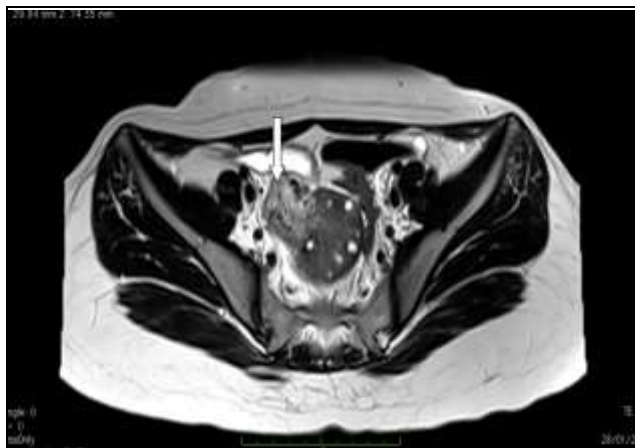
**Figure 1a.**  
Right Ovary Appears Enlarged Oedematous and Hypoechoic with Peripherally Pushed Follicles



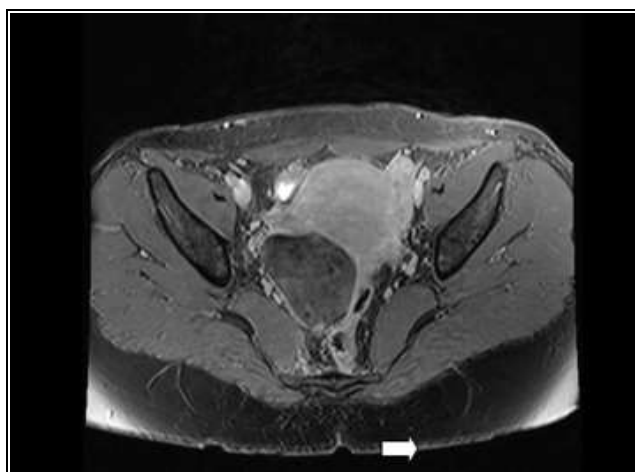
**Figure 1b.**  
Ovarian Volume of Approximately 37cc was Obtained.



**Figure 2. T2W and T1W Sequences Show Enlarged Right Ovary with Peripherally Displaced Follicles**



**Figure 3. Right Mesovarium / Suspensory Ligament of Ovary is Thickened and Twisted and Shows Prominent Ovarian Vessels within – Giving Rise to “Whirlpool Sign”. Mild Periovarian and Free Fluid in the Pelvis is Noted**



**Figure 4. On Postcontrast Study, the Right Ovary Shows Complete Lack of Enhancement**



**Figure 5. Postoperative Images Show Areas of Haemorrhage in the Ovary**

## DISCUSSION

### Ovarian Enlargement with Peripherally Displaced Follicles

In a study done by Khalil RM, El-Dieb LR et al. on 14 surgically confirmed ovarian torsion cases, using grayscale US, ovarian enlargement was detected in all patients (100 %). Size of the ovary ranged from 5.4 cm to 11 cm.<sup>1</sup> The most common findings were peripherally displaced follicles and cul-de-sac collection being found in 10 patients (71.4 %). In our study, there is significant enlargement of the ovary with size ranging from 5 to 15 cm in all patients (100 %). Ovarian enlargement was reported on the right

side in 8 cases (80 %) and on left side in 2 cases (20 %). Peripherally displaced follicles and cul-de-sac collection were found in all 10 (100 %) patients. The present study is in concordance with the study conducted by Khalil RM, El-Dieb LR et al.

### Oedematous Echogenic Stroma

In a study done by Albayram F, Hamper UM et al. included 15 patients with surgical confirmation of ovarian or adnexal torsion. Out of these 8 patients showed oedematous echogenic ovarian stroma.<sup>3</sup> In our study, oedematous echogenic ovarian stroma was noted in 8 cases on USG. Stromal oedema showing increased T2 signal intensity was seen in eight cases on MRI. Our study has similar results in comparison with Albayram F, Hamper UM et al.

### Ovarian Subacute Haemorrhage

In a study conducted by Singh T et al. in 10 females with surgically proven ovarian torsion, subacute haemorrhage within the ovarian stroma was seen in eight cases on MRI.<sup>4</sup> In our study, subacute haemorrhage showing hyperintense signal intensity on T1W, T2W sequences and not suppressed on FS sequences within the ovarian stroma was seen among 3 cases. Patients who had ovarian haemorrhage were found to have infarcted ovaries intraoperatively.

### Underlying Ovarian Lesion

In a study done by Albayram F, Hamper UM et al. Cystic lesions were present in 5 (33 %) of 15; these included 2 haemorrhagic corpus luteum cysts, 1 serous cyst, 1 mucinous cyst, and 1 undifferentiated cyst on pathologic examination. Four patients (27 %) had an underlying neoplasm as the cause of their torsion. Dermoid was the most common neoplasm in 3 (20 %) of the 15 patients.<sup>3</sup> In our study, ovarian cysts were found in 7 cases and dermoid in 1 case. Underlying pathological lesions were simple cystic lesions in 5 cases without any solid components, haemorrhagic cysts in two cases and dermoid in one case.

### Twisted Ovarian Pedicle

In a study conducted by Singh T et al. in 10 females with surgically proven ovarian torsion. Twisted ovarian pedicle is the pathognomic sign seen in seven patients on MRI. The fallopian tube or vascular channels were seen in helical configuration on MRI. Due to the twisted pedicle, beaking of the margin of an enlarged ovary was also seen.<sup>4,5,8</sup> In our study, classic whirlpool sign in the form of abnormally tortuous vessels was depicted in 2 cases only on USG. The classic whirlpool sign was depicted in 6 cases on MRI. Two patients had beaking of the ovary into twisted pedicle.

### Abnormal Ovarian Enhancement

In a study conducted by Duigenan S et al. the torqued ovary is characterised by disrupted blood flow, which is seen as abnormal enhancement on MRI after IV contrast agent

administration.<sup>8</sup> Kimura et al. study reported that 3 cases had complete absence of enhancement. In six patients, non-enhancement of ovarian stroma was seen in our study. Intraoperatively all these patients had non-viable ovaries. Peripheral enhancing wall of ovaries were seen in two cases. In the early stage of ovarian torsion or intermittent torsion, normal enhancement may be seen. Nevertheless heterogeneous, minimal to absent enhancement is seen in infarcted ovaries. They may show only peripheral enhancement.

### **Ipsilateral Deviation of Uterus**

Uterine deviation towards the same side so that the ovary was seen in the midline was detected in 7 cases.

### **Free Fluid in Pouch of Douglas (POD)**

In our study, ovarian enlargement with peripherally displaced follicles and free fluid in pelvis were found to be the most common findings on ultrasound.

### **Colour Doppler**

Colour Doppler imaging shows abnormal central vasculature in 7 cases; in 3 of them flow was absent and in the other 2 it was decreased. The classic whirlpool sign in the form of abnormally tortuous vessels was depicted in 2 cases only. Normal flow was seen in 3 cases.

The presence of arterial or venous flow or both does not exclude the diagnosis of torsion<sup>9,10</sup> Venous thrombosis leads to symptoms before arterial occlusion and that persistent adnexal arterial flow is related to the dual-ovarian arterial supply (ovarian artery and ovarian branches of uterine artery).

## **CONCLUSIONS**

Ultrasound and MRI are the main diagnostic imaging modalities prior to treatment. Improved detection and characterisation of pelvic mass contribute to better diagnostic accuracy. The most common features of ovarian torsion in US and MRI include ovarian enlargement with peripherally displaced follicles and free fluid in pelvis. Other common MRI features include ovarian haemorrhage, twisted vascular pedicle, abnormal ovarian enhancement and deviation of the uterus towards the same side.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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