Susceptibility-weighted Imaging of Ovarian Torsion: A Case Report

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(Received July 9, 2014; Accepted October 29, 2014; published online February 12, 2015)

We report findings of magnetic resonance imaging including susceptibility-weighted imaging (SWI) of the subacute torsion of an ovarian fibrothecoma in a patient with renal dysfunction. Although venous thrombosis within the vascular pedicle mimicked a malignant tumor, showing high signal intensity on T2-weighted images and diffusion-weighted imaging, we diagnosed ovarian torsion on SWI without the administration of contrast medium, aided by the prominent susceptibility-induced signal void caused by the thrombosis.

Keywords: magnetic resonance imaging (MRI), ovary, susceptibility-weighted imaging (SWI), torsion, venous thrombosis

Introduction

Ovarian torsion is an uncommon gynecologic emergency usually caused by twisting of an ovarian mass along the vascular pedicle that obstructs venous outflow and arterial inflow.1–4 Ovarian torsion may affect women of all ages but commonly occurs during reproductive age, and about 17 to 20% of cases occur during pregnancy.4 Typical ovarian torsion causes acute abdomen, but some patients may experience mild, intermittent pain; in subclinical cases, clinical and radiological diagnosis of ovarian torsion may be difficult.4 Complete torsion requires immediate surgical treatment because if it is left untreated, hemorrhagic necrosis and infection can lead to severe complications, such as peritonitis, sepsis, and, in some cases, death.2 Fallopian tube thickening, ascites, and uterine deviation to the twisted side are common findings of ovarian torsion on computed tomography (CT) and magnetic resonance (MR) imaging.1–4 Lack of contrast enhancement also suggests complete torsion.1 However, contrast-enhanced imaging with gadolinium-containing agents is generally avoided in patients during pregnancy or in patients with severe to end-stage renal insufficiency because of the risk of the development of nephrogenic systemic fibrosis.5

Susceptibility-weighted imaging (SWI) is based on a T2*-weighted gradient echo sequence and utilizes both magnitude and phase information to enhance susceptibility variations between tissues.6,7 SWI allows visualization of blood products as signal voids, demonstrating hemorrhagic contents and thrombosis in the vascular pedicle that may aid the diagnosis of ovarian torsion. In addition, SWI has the advantage of not requiring gadolinium-containing agents.

We report a case of ovarian torsion in a subacute to intermittent course diagnosed with the help of SWI.

Case Report

A postmenopausal 59-year-old woman, gravida 3, para 2, abort 1, was referred to our hospital with intermittent right lower abdominal pain of 3 months’ duration. On admission, serum biochemistry revealed anemia (red blood cell count, 3.45 × 10^6/µL; hemoglobin, 8.6 g/dL), increased white blood cell count (10.5 × 10^3/µL), and renal dysfunction (creatinine, 1.81 mg/dL). Cancer antigen 125 (200 U/mL) and Sialyl Lewis X (46.8 U/mL) were elevated. Plain CT revealed a large pelvic mass with ascites. We suspected ovarian tumor, and the patient underwent pelvic MR examination on a system with a 3-tesla superconducting unit (Signa HDx 3T, GE Healthcare, Milwaukee, WI, USA). MR images (Fig. 1A–D) showed a large solid right adnexal mass that exhibited inhomogeneous high
signal intensity on T₂-weighted images. We observed a hemorrhagic cystic portion situated peripherally and a vascular pedicle protruding posteriorly. The twisted vascular pedicle showed intermediate high signal intensity on T₂-weighted images, inhomogeneous high signal intensity on diffusion-weighted images (DWI), and partially high signal intensity on fat-saturated T₁-weighted images. Renal dysfunction prohibited contrast-enhanced imaging. SWI demonstrated the twisted vascular pedicle as a prominent signal void that suggested the presence of thrombosis and/or blood clots. We suspected subacute torsion of an ovarian tumor and performed a right oophorectomy. The subsequent pathological examination revealed a benign fibrothcoma with hemorrhagic infarction due to complete torsion and venous thrombosis within the twisted vascular pedicle (Fig. 2).

Fig. 1. (A) Fast spin-echo T₂-weighted image (repetition time [TR]/effective echo time [TE], 7000 ms/107.5 ms) shows a solid mass in the right ovary exhibiting inhomogeneous high signal, peripherally situated cystic portion with strong high intensity (arrow), and posteriorly protruding twisted vascular pedicle with intermediate high signal (arrowheads). (B) On fat-saturated spin-echo T₁-weighted image (TR/TE, 666.7 ms/9.2 ms), the solid mass shows low signal intensity, and the cystic portion (arrow) shows high signal intensity that suggests hemorrhagic content. Peripheral areas of high signal intensity are observed in the solid mass and in the twisted vascular pedicle (arrowheads). (C) On echo-planar diffusion-weighted image (TR/TE, 6000 ms/64.7 ms; b = 800 s/mm²), the areas of high intensity of the solid mass on fat-saturated T₁-weighted image also show high signal intensity. In addition, the vascular pedicle shows inhomogeneous high signal intensity throughout (arrowheads). (D) Susceptibility-weighted imaging (SWI) consists of magnitude and phase images from 2-dimensional fast spoiled gradient recalled echo (FSPGR) acquisition in the steady state (TR/TE, 620 ms/30 ms). Post-processing was applied to the magnitude images multiplied with a phase mask generated from the filtered phase data. The vascular pedicle appears as a prominent signal void (arrowheads).
Ovarian torsion is usually associated with an ovarian tumor or cyst and rarely affects normal ovaries. Acute torsion may cause acute abdomen with sharp, localized lower abdominal pain and tenderness, whereas subacute or chronic torsion may manifest mild, intermittent pain or, occasionally, no symptom. In subacute or chronic cases, the twisted benign ovarian mass or enlarged normal ovary may mimic a malignant ovarian tumor. In our case, the ovarian mass was pathologically diagnosed as benign fibrothecoma. However, the MR appearance of ovarian torsion can simulate that of a malignant ovarian tumor, appearing, for example, as a solid mass of inhomogeneous high signal intensity on T2-weighted images with a portion protruding posteriorly that exhibits inhomogeneous high signal intensity on DWI. Fujii and colleagues reported that high signal intensity on DWI of thickening of the Fallopian tubes of ovarian torsion reflected congestion and edema. They suggested that blood clots within the tube and venous thrombosis might also contribute to the abnormal signal intensity on DWI. Ve nous thrombosis within the twisted vascular pedicle may be specific for ovarian torsion, but malignant tumors may also show high signal intensity on DWI. In our case, SWI demonstrated prominent signal void in the twisted vascular pedicle that suggested the presence of blood products. Fat-saturated T1-weighted images also demonstrated with high signal intensity a hemorrhagic portion in the twisted vascular pedicle, but only a part of the thrombus showed high signal intensity. Fat-saturated T1-weighted images may be useful in detecting hemorrhage within the thickened tube of ovarian torsion, but Rha’s group reported this finding in only 16% of cases. SWI combines magnitude and phase information and demonstrates susceptibility effects caused by local inhomogeneity of the magnetic field as signal voids. SWI can detect substances with different susceptibilities than their adjacent tissues, such as blood products or small veins. SWI is commonly used in neuroimaging to evaluate micro-bleeding foci of diffuse axonal injury, detect occult vascular diseases, identify iron deposition, and perform high resolution venography of the brain. Recently, SWI has been applied clinically in many other body regions. In gynecology, Takeuchi and associates reported the usefulness of SWI in diagnosing endometrioma in its depiction of hemosiderin deposition within the walls of endometriomas. Solak’s group reported the signal changes on SWI of endometriosis in the abdominal wall during different phases of the menstrual cycle, which contributed to the diagnosis. To our knowledge, this is the first report regarding the SWI findings in ovarian torsion.

Although SWI is sensitive in detecting blood products, calcification may also appear as signal voids on SWI. In our case, plain CT revealed no calcification that corresponded to the prominent signal voids on SWI. If CT is not available, SWI phase images can be used to distinguish calcification (low signal intensity) from hemorrhagic regions (high signal intensity). Hemorrhage within malignant tumors may also appear as signal void on SWI, and intratumoral hemorrhage may be difficult to distinguish from venous thrombosis on SWI. However, intratumoral hemorrhage tends to occur in the central area of tumors, whereas venous thrombosis within the twisted vascular pedicle situates peripherally in the tumors.

In conclusion, venous thrombosis or blood clots within the twisted vascular pedicle of ovarian torsion may show signal voids on SWI. Diagnosis of such findings as ovarian torsion would be feasible, particularly in a subacute or chronic course in which clinical diagnosis of ovarian torsion can be difficult. In addition, SWI does not require the administration of gadolinium-containing agents and can be easily added to an MR examination protocol, especially for patients with renal dysfunction, with allergy to gadolinium-containing agents, or during pregnancy.
References


