The utility of diffusion-weighted magnetic resonance imaging in differentiation of endometriomas from hemorrhagic ovarian cysts

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Aims and objectives

Adnexa are anatomic regions between pelvic walls and uterine cornus. A mass in this region generally originates from ovaries and many of them can mimic each other with similar imaging findings. From these pathologies, differentiation of endometrioma from hemorrhagic ovarian cyst can be challenging (1). It becomes important to differentiate endometrioma that have coexistence with endometriosis from hemorrhagic ovarian cyst that spontaneously resolves with no associated malignity risk.

The role of magnetic resonance (MR) imaging in evaluation of pelvic gynecologic pathologies was considerably increased in recent years (2). Despite the usefulness of ultrasonography in characterization of adnexial masses, MRI is a superior imaging method with an accuracy rate over 90% and generally used as a problem solver (2).

In the present study, we aimed to determine the utility of diffusion-weighted MR imaging and apparent diffusion coefficient (ADC) measurements in differentiation of endometrioma from hemorrhagic ovarian cyst.

Methods and materials

A total of 24 female patients who referred to our department for pelvic MRI with a suspected gynecologic mass were included in this study. From the study patients, 6 were operated and 18 were followed up. According to the histopathologic evaluation and follow up results, the final diagnosis was endometrioma for 12 lesions and hemorrhagic ovarian cyst for 12 lesions.

All patients underwent pelvic MRI with a 1.5 Tesla MR unit. T2 weighted images were used for detection of lesion and lesion diameters. The DW imaging protocol included water excitation with three $b$ values (100, 600 and 1000s/mm$^2$) and apparent diffusion coefficient (ADC) maps were created. ADC values were measured in 24 ovarian cysts. Calculated ADC values for $b$ values of 100, 600 and 1000 s/mm$^2$ were compared for groups.
Results

A total of 24 female patients with ovarian lesions were included in this study. At the time of the imaging, the mean age of the patients was 33.4 years ± 10.8 (standard deviation; range, 18-58 years). The mean size of all lesions was 4.9 cm ± 2.1 (standard deviation; range, 2.5-11 cm), endometriomas was 4.5 cm ± 1.4 (standard deviation; range, 3-7.5 cm) and hemorrhagic ovarian cysts was 5.3 cm ± 2.7 (standard deviation; range, 2.5-11 cm). Conventional MR images of detected lesions were evaluated. T1 weighted (T1W) and T2W MR images were heterogeneous for both lesions depending on the stage of the blood they contain. On DW MR images, all lesions were hyperintense compared with the surrounding tissue (Figure 1, 2).

The mean ADC values (x10^{-3} mm^2/s) of endometriomas were 1.84 ± 0.5 for $b_{100}$, 1.42 ± 0.3 for $b_{600}$, and 1.15 ± 0.2 for $b_{1000}$. The mean ADC values (x10^{-3} mm^2/s) of hemorrhagic ovarian cysts were 2.70 ± 0.7 for $b_{100}$, 2.32 ± 0.6 for $b_{600}$, and 2.10 ± 0.1 for $b_{1000}$. There were significantly lower ADC values in endometriomas in all $b$ values (p= 0.004 for $b_{100}$, p=0.001 for $b_{600}$, p=0.001 for $b_{1000}$) (Figure 3).

Images for this section:

**Fig. 1:** Figure 1 A histopathologically proven endometrioma with heterogenous appearance in left ovary is seen. It is hyperintense on fat-saturated T1W image (a) and hypointense on T2W image (b). DW MR image demonstrates hyperintense appearance in the cyst (c). ADC was measured as 1.5x10^{-3} mm2/s with b600 (d).
**Fig. 2:** A hemorrhagic ovarian cyst in the left ovary is seen. The lesion is hyperintense on T1W (a), T2W (b) and DW MR imaging (c) images. ADC was measured as $1.74 \times 10^{-3} \text{ mm}^2/\text{s}$ with $b600$ (d).

**Fig. 3:** Box plot shows ADC values of endometrioma and hemorrhagic ovarian cysts according to $b100$, $b600$ and $b1000$. 
Conclusion

Endometriomas and hemorrhagic ovarian cyst are common ovarian pathologies and differentiation of one from the other one can be challenging. Endometriosis is a frequent cause of dysmenorrhea, pelvic pain and infertility. In the presence of infertility, the prevalence of endometriosis is about 20% and in 30-50% of the women with endometriosis, there are varying degrees of infertility (3, 4).

Ectopic endometrial tissue is sensitive to hormonal stimuli and blood filled cysts occur due to the hemorrhages according to the menstrual cycle. Hemorrhagic ovarian cysts occur due to the hemorrhage within the functional cysts and resorbes spontaneously (5). By the way, the differentiation of endometrioma from hemorrhagic ovarian cyst is important for appropriate surgical approach and treatment plan.

MRI is a superior imaging modality in pelvic region compared with other imaging methods as it has high soft tissue resolution. DW MR imaging is a new technique that shows the molecular diffusion difference (6-8) and also gives quantitative biophysical parameter of the water called ADC (9,10). There are previous studies comparing ADC values of different ovarian lesions in the literature (11-13). However, there is not such a study comparing ADC values of endometriomas and hemorrhagic ovarian cysts available in the literature. In our study, we aimed to demonstrate ADC values of endometriomas and hemorrhagic cysts and to determine the utility of DW MR imaging in discriminating these two lesions.

We observed significantly lower ADC values in endometriomas compared with hemorrhagic ovarian cysts in all $b$ values with a higher sensitivity and specificity at $b1000$.

In conclusion, DW MR imaging with quantitative ADC measurements can be used for differentiation of endometrioma from hemorrhagic ovarian cysts.

Personal information

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