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MR Imaging Evaluation of the Volume Changes and the Signs of Deformation in the Breasts with Granulomatous Mastitis

Granülomatöz Mastit Olgularında Memede Volüm Değişikliği ve Deformasyon Bulgularının Manyetik Rezonans Görüntüleme ile Değerlendirilmesi

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ABSTRACT

Objectives: The objective of this study was to evaluate the volume changes and the findings of deformation in the breasts with granulomatous mastitis and to compare the findings with the contralateral normal breasts.

Methods: This retrospective study included histopathologically proven 15 granülomatous mastitis (GM) patients. Breast diameters in three planes and the volume were measured on Magnetic resonance imaging (MRI). Parenchymal edema, nipple retraction, and deformation of the breast were noted.

Results: The measurements were only showed significant increase in sagittal diameter (124.4±26 mm and 116±22.9 mm, for diseased and normal breasts, respectively) and volume (329.3 cc [IQR: 245–572 and 281.6 cc [IQR: 217.3–310.3] for diseased and normal sides, respectively) in the breasts with GM when compared with normal side ($p<0.05$). Coronal diameter was lesser in the diseased side without significant difference. Ten patients showed parenchymal edema (66.6%), four patients had deformation (26.6%), and five patients had nipple retraction (33.3%) on MRI.

Conclusion: GM enlarges the breast volume in the affected side which is related with the increase in the axial and sagittal diameters. On the contrary, the disease causes a reduction in the coronal diameter. Deformation and nipple retraction may occur to some extent, in the course of the disease.

Keywords: Breast; granulomatous mastitis; MRI.

ÖZET

Amaç: Bu çalışmanın amacı, granülomatöz mastit olan olgularda meme dokusundaki hacim değişikliklerinin ve deformasyonun manyetik rezonans bulgularını değerlendirmek ve diğer taraf normal meme ile karşılaştırmaktır.

Yöntem: Bu retrospektif çalışma, histopatolojik olarak kanıtlanmış 15 granülomatöz mastit hastasını içermektedir. Üç planda meme boyutları ve meme hacmi hesaplandı. Parankimal ödem, meme başında çekilme ve memede deformasyon bulguları not edildi.

Bulgular: Ölçümler, sadece sagital boyut (hasta ve normal memeler için sırasıyla, 124,4±26 mm ve 116±22,9 mm) ve hacimde [hasta ve normal memeler için sırasıyla, 329,3 cc (IQR:245-572 cc) ve 281,6 cc (IQR:217,3-310,3 cc)] anlamlı artış olduğunu gösterdi. Koronal boyut hasta tarafta daha küçük olmakla birlikte, anlamlı farklılık göstermedi. Parankimal ödem 10 (%66,6) hastada, deformasyon 4 (%26,6) hastada, meme başında çekilme 5 (%33,3) hastada saptandı.

Sonuç: Granülomatöz mastit, etkilenen tarafta meme hacmini artırmakta olup bu artış sagital ve aksiyel çap artışlarıyla ilişkilidir. Bunun aksine hastalık, koronal çapta küçülmeye neden olmaktadır. Deformasyon ve meme başında çekilme hastalığın seyri sırasında belli oranlarda gelişebilmektedir.

Anahtar sözcükler: Granülomatöz mastit; meme; manyetik rezonans görüntüleme.

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Idiopathic granülomatous mastitis (GM) is a chronic, benign, and inflammatory disease of the breast. GM generally affects childbearing women in reproducing age.[1-4] Pathologically, the disease has a characteristic of non-caseating granulomas originating from lobules without major necrosis and microabscess formations may be seen.[5] Although the exact etiology of GM is still unknown, several factors have been considered including pregnancy, lactation oral contraceptives, hyperprolactinemia, trauma, and diabetes.[6-8] GM may mimic the breast cancer both clinically and radiologically.[9-11] On the other hand, the chronic pattern of the disease and the deformation of the breast due to the disease itself and the surgeries which is needed for the treatment of refractory cases lead to cosmetic and psycologic problems.[12]

Magnetic resonance imaging (MRI) is used in the cases which cannot be differentiate from breast cancer both clinically and with conventional radiologic modalities including mammography and ultrasonography.[13] In refractory cases, MRI also is performed to understand the extent of the disease. To the best of our knowledge, there is no article evaluating the effects of GM on the breast volume and deformation. This study aimed to search the volume changes and the signs of deformation.

Methods

This retrospective study was approved by the Local Ethical Committee. The study was conducted in accordance with the principles of the Helsinki Declaration. Histopathologically proven, 21 GM patients were evaluated consecutively, between May 2018 and January 2020. Patients with a diagnosis of GM who clinically and radiologically having unilateral disease, age range of 18–70 years, and a complete breast MR examination were included in the study. Patients with a history of breast cancer or breast surgery and bilateral disease were excluded from the study. Finally, 15 patients were enrolled. Breast MRI was performed with a 1.5 Tesla MR imaging system (General Electric Healthcare, Milwaukee, WI).

Dedicated eight channel breast coil was used. Images were taken when patient was placed in prone position. Imaging protocol included T1-weighted fast spin-echo, T2-weighted fat suppressed fast spin-echo, diffusion-weighted echo-planar images with diffusion gradients at b values of 0 and 800, and T1-weighted turbo 3D gradient echo dynamic contrast-enhanced images (one before and 6 after administration of IV contrast material) of bilateral breasts. Gadoterate meglumine (Dotarem, Guerbet) was automatically injected as the contrast agent at a rate of 2.0 mL/s. However, the measurements in this retrospective study were made using non-contrast sequences. MRI images were picked up from the PACS of our hospital and evaluated on a GE Advantage Workstation (GE Healthcare, Milwaukee, WI).

Measurements of the diseased breast were made from the cross-sectional 2D images by an experienced breast radiologist. Axial and coronal diameters were measured from axial T1-weghted images at the level of nipple. Sagittal measurements were made using sagittal T2-weighted images. Manual segmentation option of the software was used to measure the volume of the breast. Area of each slice on axial images was drawn (Fig. 1). Each axial section was lined along the breast skin borders and pectoral muscle posteriorly. For each breast, 20–35 segmentations with a 3 mm thickness were performed according to the breast size. Finally, each segment measurements were summed up to obtain the total breast volume in cc. Volume of the other breast was also calculated by the same method.

Parenchymal edema was searched on T2-weighted images. Any associated nipple retraction and deformation of the breast was noted (Fig. 2). Histopathological diagnoses were obtained by US-guided core needle biopsy.

Statistical evaluation was conducted with IBM SPSS Statistics 22 software (IBM SPSS, Turkey). Data were presented with means±standard deviation (SD) or median (IQR: 25–75.

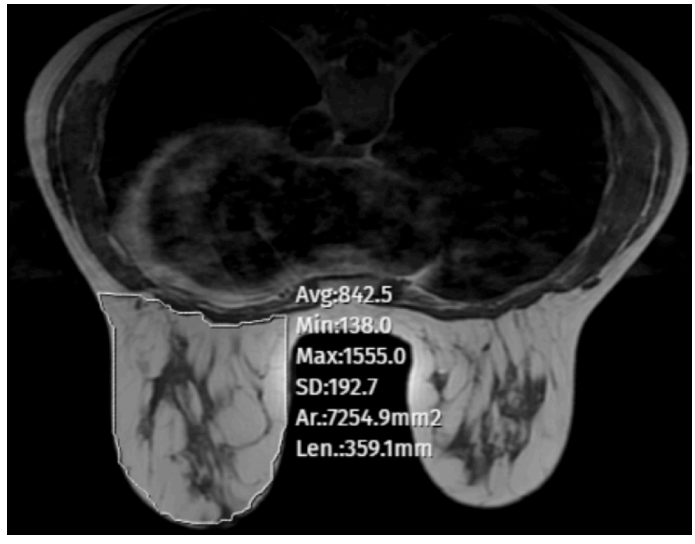

Figure 1. Manual drawing of the right breast borders on an axial slice for measuring the breast volume.

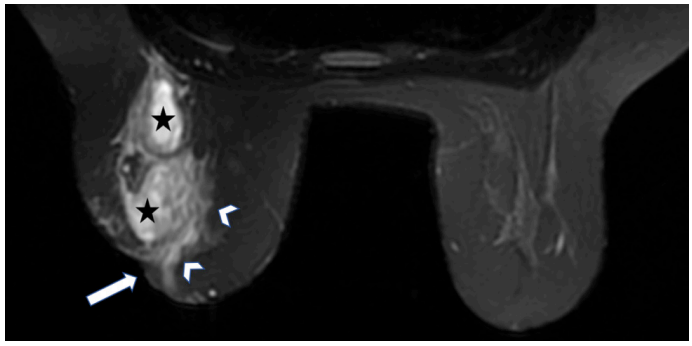

Figure 2. A 40-year-old patient with GM in the right breast. Axial T2-weighted MRI shows nipple retraction (arrow) hyperintense lesions consistent with fluid collections (stars) and parenchymal edema (arrowheads). There is no finding in the right breast.

percentile). Statistical differences were determined using the Paired Samples t-test and Wilcoxon Signed Ranks test for paired data. Significance level was set as $p<0.05$.

Results

The mean age of all the 15 patients was 40 years (range, 31–50 years).

Axial diameters of the breasts with GM were larger than the normal sides, but there were no statistical differences between two groups. Coronal diameters were reduced in 10 of 15 breasts with GM and this finding was significantly different. There was a significant difference in sagittal diameters among the two groups that the sagittal diameter was higher in the breasts with GM (124.4±26.24 mm) than the normal breasts (116±22.92) (p=0.015).

Eight of the 15 patients (53.3%) had a volume increase on the breast side with GM. The median volume was larger in the breast with GM (329.3 [IQR: 245–572]) than the normal sides (281.6 [IQR: 217.3–310.3]), and the difference was significant (p=0.016). Diameters and the volumes of the breasts included in the study are summarized in Table 1.

Ten breasts with GM had parenchymal edema (66.6%). Only five of the eight patients (62.5%) with an volume increase had parenchymal edema on the diseased side of the breast. Five patients with parenchymal edema had no volume increase on the breasts with GM. Four patients demonstrated with deformation related with GM. All of the patients with deformation had parenchymal edema but only two of them (50%) had volume increase. Five patients showed nipple retraction at the side of GM and all of the patients with nipple retraction showed parenchymal edema whereas four of them (80%) had volume increase.

All four patients with a deformation in the breast and five patients with nipple retraction had parenchymal edema in the study. Volume increase, parenchymal edema, deformation, and nipple retraction findings in patients with GM are shown in Table 2.

Discussion

The results of this study showed that GM increases the volume of the affected breast significantly. This finding could be explained by the associated diffuse parenchymal edema which is a well-known feature of GM.[14] However, only 62.5% of the objects with a breast size enlargement related with GM have diffuse parenchymal edema. Furthermore, five patients having parenchymal edema had no increase in breast volume. It seems that the parenchymal edema on T2-W MR images may not be responsible for the volume increase. According to the results of the study, the volume increase caused by the diameter increase in the axial and the sagittal planes in which sagittal diameters were significantly higher in the diseased sides (124.4±26.24 mm, 116±22.92 respectively, p=0.015). On the contrary, coronal diameters (from pectoral muscle posteriorly to the nipple anteriorly) were smaller in the breasts with GM, than the normal side of the breasts. This finding shows that GM causes a diameter reduction in coronal plane of the breast. GM is character-

Table 1. The diameter and volume measurements for diseased breasts and the normal contralateral sides

Variables	Diseased side	Contralateral side	p
Axial (mm)	90.33±14.7	85±17.42	0.066
Coronal (mm)	92.13±25.25	95.67±21.83	0.183
Sagittal (mm)	124.4±26.24	116±22.92	0.015
Volume (cc)	329.3 (245–572)	281.6 (217.3–310.3)	0.016

Values are expressed as means±standard deviation or median (IQR).

Table 2. Volume increase, parenchymal edema, deformation, and nipple retraction findings in patients with GM

Patients	Volume increase	Parenchymal edema	Deformation	Nipple retraction
1	1	1	0	1
2	0	1	0	0
3	0	0	0	0
4	0	1	0	0
5	1	0	0	0
6	1	1	1	1
7	0	0	0	0
8	0	1	1	0
9	0	1	1	0
10	1	0	0	0
11	1	1	1	1
12	0	1	0	1
13	1	1	0	0
14	1	1	0	1
15	1	0	0	0

1: existence of the finding; 0: no finding.

ized by non-caseating granulomas histologically, whereas fibrosis is less seen and as is an obscured feature of the disease.[5] Granulomas appears around the lobules and ducts.[5] The inflammatory reactions along the ducts and lobules may cause a reduction in the coronal diameter of the breast. However, associated lesions such as microabscess may lead to an increase in the diameters of other planes and a volume enlargement of the affected breast.

There are studies in the literature investigating the MRI feature of GM.[15-18] These papers generally focused on the characteristics of GM lesions on contrast-enhanced series.

MRI findings may change depending on the severity of the disease. Ill-defined masses and non-mass enhancement are the most described findings of GM.[19] However, the volume changes on MRI in patients with GM have not been examined before as we know.

Five patients had deformation and four patients had nipple retraction in the study. Nipple retraction was reported as a supportive finding of chronic and granulomatous disease in the breast.[20] All five patients with deformation and four patients with nipple retraction had parenchymal edema on T2-weighted MR images. This may be explained by the lesions of the disease cause a damage in the parenchyma which is also associate with edema. Volume increase associated in only two of the patients with deformation (50%) and four of the patients with nipple retraction (80%).

This study has limitations. First limitation is the retrospective nature of the study. Second, the sample size was relatively small. Further studies with larger sample size will be more demonstrative.

Conclusion

In conclusion, GM enlarges the breast volume in the affected side which is related with the increase in the axial and sagittal diameters. On the contrary, the disease causes a reduction in the coronal diameter. Deformation and nipple retraction may occur in the course of the disease.

Disclosures

Ethics Committee Approval: Fatih Sultan Mehmet Training and Research Hospital Clinical Research Committee granted approval for this study (date: 14.06.2021, number: 2021/7831).

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Conflict of Interest: None declared.

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