Variation of Breast Vascular Maps at Dynamic Contrast-Enhanced MR Imaging before and after Neoadjuvant Chemotherapy of Locally Advanced Breast Cancer.

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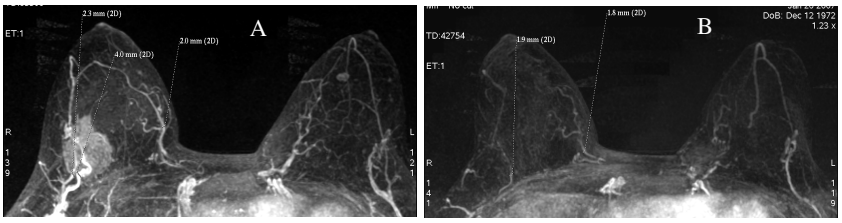
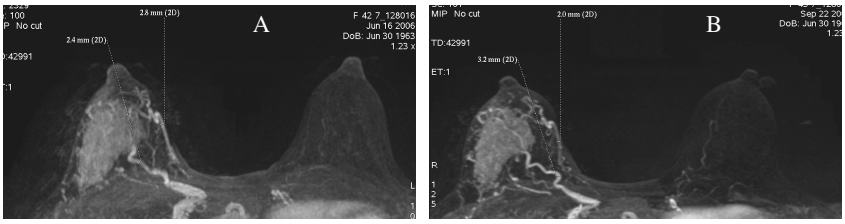
PURPOSE: The evaluation of breast vascular maps by Dynamic Contrast-Enhanced MRI (DCE-MRI) has been recently investigated, showing a strong association between asymmetric increase of vascularization and ipsilateral invasive breast cancer. In-vitro studies have demonstrated that inhibition of tumor growth by chemotherapeutic drugs, included taxanes, was associated with suppression of angiogenesis. Furthermore, it is widely known that the pathological response to neoadjuvant chemotherapy (NCT) represents an important prognostic factor in women with locally advanced breast cancer, indicative of disease-free time and overall survival.
To our knowledge, in-vivo effect of NCT on breast vascularity has not been exhaustively studied by MRI. The aim of the study was to evaluate if variation of whole breast vascular maps may occur after NCT.

METHODS AND MATERIALS: Thirty-four patients with unilateral LABC (stage II with T>3 cm or stage IIIA/B) were retrospectively evaluated (age 46 years; range 32-63). Each woman underwent DCE-MRI before and after taxane-based NCT. MR imaging was performed using an axial 3D gradient-echo sequence before and five times after intravenously administration of 0.1mmol/kg of Gd-DTPA with a temporal resolution ranging 60-90s, depending on the volume of the breasts. Before and after the treatment, the number of vessels ≥2 mm in diameter and ≥3 cm in length were counted on axial/coronal maximum intensity projections (MIP) of the first subtracted phase for each of the two breasts and considered for the analysis. Pathological response was classified according to a five point assessment scheme described by Smith et al (JCO 2002). Patients who achieved grade 5 (pathological complete response) or 4 (small cluster of residual cancer cells after NCT) were classified as responders (R); those obtaining a response scored 1-3 were defined as non-responders (NR). After NCT, the variation in number of the considered vessels was correlated with the pathological response and then evaluated for R versus NR patients.

RESULTS: Before NCT, the number of vessels was 2.7±1.3 in the breast harboring the cancer and 1.1±1 in the contralateral (P=.0001) while after NCT it was 1.3±1.1 and 1.1±1.1 (P=n.s.). After NCT, the mean reduction of vascular maps was significant in the breast harboring the cancer (P<.0001) but non significant in the contralateral one. In the 10 responder patients, the number of vessels in the breast harboring the cancer changed from 2.7±1.1 to 0.6±0.8 (P=.01) while in the 24 non-responder from 2.7±1.4 to only 1.6±0.9 (P=n.s.). The mean reduction of vascular maps in the breast harboring the cancer was significantly higher in responders if compared to non-responder patients (P=.006).



A 35-y.o. patient with a locally advanced breast cancer at the external quadrants of the right breast, receiving NCT. Before the treatment (A) three vessels ≥2 mm in diameter and ≥3 cm in length were detected on axial MIP images, while after NCT (B) no vessels ≥2 mm in diameter and ≥3 cm in length were countable. At pathology the patient obtained a grade 4 and was considered as responder.



A 44-y.o. patient with a locally advance breast cancer on the right breast undergoing NCT. Before (A) and after (B) the treatment two vessels ≥2 mm in diameter and ≥3 cm in length were identified on axial MIP images. At pathology the patient obtained a grade 1 and was considered as non- responder.

CONCLUSION: Our results show that DCE-MRI is able to assess variation of whole breast vascular map occurring after NCT, which are probably a consequence of the antiangiogenic non-selective activity of taxanes. Before NCT, vascular maps were asymmetrically increased ipsilaterally to LABC; after treatment the variation of vascular maps was only significant in the breast harboring the cancer. Vascular maps reduced in both the groups of R and NR patients but a significant decrease was observed in the R group only. The evaluation of breast vascularity by DCE-MRI may have a role in the evaluation of tumor response, identifying patients who better benefit from therapy. The fact that it does not require an increase in acquisition time or dedicated contrast agents may be an advantage for clinical application; however further studies are warranted to confirm the results with other NCT regimens.

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