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Editorial: Impact of Breast MRI on Breast Cancer Treatment and Prognosis

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Editorial on the Research Topic

Impact of Breast MRI on Breast Cancer Treatment and Prognosis

Breast cancer treatment and prognosis depends on the extent of the disease at diagnosis (staging) and biological characteristics of the tumor. While staging is mainly based on clinical and imaging features, biological characteristics used to define treatment are usually based on the analysis of needle biopsy samples, which represent only a small portion of the tumor and are subject to sampling bias (1, 2). Breast Magnetic Resonance Imaging (MRI) has become a fundamental method in the management of breast cancer patients. In addition to morphology assessment, MRI can provide functional information on whole tumor aggressiveness and intratumoral heterogeneity, which contributes to the characterization of breast tumors (3, 4). Radiomics, radiogenomics and AI studies have been using MRI data to predict breast cancer subtypes, clinical outcomes and response to neoadjuvant chemotherapy (5, 6). The aim of this Research Topic was to discuss the increasing role of breast MRI in improving the management of breast cancer patients, emphasizing technical advances that allow better correlation between MRI findings and histologic, immunohistochemical, and molecular features, as well as response assessment and treatment outcomes.

MRI has proven to be superior to conventional imaging (mammography and ultrasound) for preoperative staging and response evaluation to neoadjuvant chemotherapy (7–10). When used for locoregional staging, MRI is able to identify additional tumor foci in about 20% of patients on the same breast and 5.5% on the contralateral breast, modifying treatment in up to one third of patients with breast cancer (11). Besides that, MRI may improve the characterization of regional lymph node basins (12). In example, Zhou et al. presented a case of a breast cancer patient with intercostal lymph node metastasis identified only on MRI.

The papers published in this special issue studied technical advances that have allowed MRI to evolve in the characterization of breast lesions and artifacts with no need for contrast administration. Li et al. performed a meta-analysis of 13 studies on the differential diagnosis of breast tumors using diffusion kurtosis imaging (DKI)-parameters, including 867 malignant and 460 benign breast lesions. They showed that DKI-derived mean kurtosis (MK) and mean diffusivity (MD) can be used to discriminate breast tumors and to differentiate invasive ductal carcinoma from ductal carcinoma in situ. Prvulovic Bunovic et al. showed that magnetic resonance spectroscopy (MRS) can be used as an additional tool for improving specificity in breast cancer detection.

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However, although elevation of the choline peak on MRS has a good sensitivity and specificity in breast cancer detection, both are significantly lower than those of multiparametric MRI. Rizzo et al. compared unenhanced MRI (including diffusion-weighted and T2-weighted imaging) combined with digital breast tomosynthesis (DBT) and dynamic contrast enhanced (DCE)-MRI in 84 women with known breast cancer. Despite DCE-MRI was the most sensitive imaging technique in breast cancer preoperative staging, unenhanced MRI combined with DBT demonstrated good sensitivity and accuracy in lesion detection and tumor size assessment and could be a valid alternative tool for preoperative staging. At last, Eskreis-Winkler et al. developed a multispectral imaging (MSI) technique to accurately identify metallic biopsy markers on breast MRI-guided breast biopsy and may eliminate the need for a post-procedure mammogram, thus improving the clinical workflow and eliminating the use of ionizing radiation. Besides that, this technique could be used to better locate metallic markers in the breast and axilla in cases with complete imaging response after neoadjuvant treatment.

Other papers in this issue demonstrated that MRI can also provide information on tumor aggressiveness and response to treatment. Liu et al. prospectively assessed 67 patients with no special type invasive breast carcinoma submitted to preoperative DCE-MRI and showed that quantitative perfusion parameters can correlate with molecular biological expression and molecular subtypes. Zhang et al. associated tumor Oncotype Dx recurrence score with background parenchymal enhancement (BPE) in the contralateral non-tumor breast in 80 breast cancer patients, suggesting that the breast microenvironment may relate to the likelihood of recurrence and magnitude of chemotherapy benefit. Montemezzi et al. found that radiomic features extracted from 3T DCE-MRI consistently improved predictive models of complete response to neoadjuvant chemotherapy.

In conclusion, breast MRI has emerged as an important complementary and noninvasive tool to assess breast cancer, providing information not only related to disease extent but also related to the tumor biology and prognosis. In this context. this Research Topic is a comprehensive collection of illustrative examples of papers that show the potential of breast MRI to improve our knowledge on the behavior of different breast cancer subtypes, which may aid in directing appropriate personalized treatment in the future.

AUTHOR CONTRIBUTIONS

All authors contributed to manuscript, read, and approved the submitted version.

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REFERENCES

1. Waks AG, Winer EP. Breast Cancer Treatment. *JAMA* (2019) 321:288. doi: 10.1001/jama.2018.19323
2. Harbeck N, Penault-Llorca F, Cortes J, Gnant M, Houssami N, Poortmans P, et al. Breast Cancer. *Nat Rev Dis Prim* (2019) 5:66. doi: 10.1038/s41572-019-0111-2
3. Mann RM, Cho N, Moy L. Breast MRI: State of the Art. *Radiology* (2019) 292:520–36. doi: 10.1148/radiol.2019182947
4. Iima M, Honda M, Sigmund EE, Ohno Kishimoto A, Kataoka M, Togashi K. Diffusion MRI of the Breast: Current Status and Future Directions. *J Magn Reson Imaging* (2020) 52:70–90. doi: 10.1002/jmri.26908
5. Pinker K, Chin J, Melsaether AN, Morris EA, Moy L. Precision Medicine and Radiogenomics in Breast Cancer: New Approaches Toward Diagnosis and Treatment. *Radiology* (2018) 287:732–47. doi: 10.1148/radiol.2018172171
6. Bitencourt A, Daimiel Naranjo I, Lo Gullo R, Rossi Saccarelli C, Pinker K. AI-Enhanced Breast Imaging: Where Are We and Where Are We Heading? *Eur J Radiol* (2021) 142:109882. doi: 10.1016/j.ejrad.2021.109882
7. Ray KM, Hayward JH, Joe BN. Role of MR Imaging for the Locoregional Staging of Breast Cancer. *Magn Reson Imaging Clin N Am* (2018) 26:191–205. doi: 10.1016/j.mric.2017.12.008
8. Kuhl CK, Lehman C, Bedrosian I. Imaging in Locoregional Management of Breast Cancer. *J Clin Oncol* (2020) 38:2351–61. doi: 10.1200/JCO.19.03257
9. Fowler AM, Mankoff DA, Joe BN. Imaging Neoadjuvant Therapy Response in Breast Cancer. *Radiology* (2017) 285:358–75. doi: 10.1148/radiol.2017170180
10. Rauch GM, Adrada BE, Kuerer HM, van la Parra RFD, Leung JWT, Yang WT. Multimodality Imaging for Evaluating Response to Neoadjuvant Chemotherapy in Breast Cancer. *Am J Roentgenol* (2017) 208:290–9. doi: 10.2214/AJR.16.17223
11. Plana MN, Carreira C, Muriel A, Chiva M, Abraira V, Emparanza JI, et al. Magnetic Resonance Imaging in the Preoperative Assessment of Patients With Primary Breast Cancer: Systematic Review of Diagnostic Accuracy and Meta-Analysis. *Eur Radiol* (2012) 22:26–38. doi: 10.1007/s00330-011-2238-8
12. Marino MA, Avendano D, Zapata P, Riedl CC, Pinker K. Lymph Node Imaging in Patients With Primary Breast Cancer: Concurrent Diagnostic Tools. *Oncologist* (2020) 25:e231-e242. doi: 10.1634/theoncologist.2019-0427

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